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ABSTRACT

The National Household Education Survey (NHES) was conducted for the first time in 1991 to collect data on the early childhood education (ECE) experiences of young children and participation in adult education. Because the NHES methodology is relatively new, field tests were necessary. A large field test of approximately 15,000 households was conducted during the fall of 1989 to examine several methodological issues. This report analyzes data from the Current Population Survey to identify the extent of telephone undercoverage for 14- to 21-year-olds and 3- to 5-year-olds and bias related to undercoverage for estimates of school dropouts and ECE program participation. Methods for adjusting survey estimates to reduce this bias partially are developed and evaluated. Recommendations are given to improve sampling accuracy for both populations. For estimation of 14- to 21-year-olds in the NHES, it recommended that the mean adjusted poststratified estimator be used because it incorporates an additional smoothing over the within-cell adjusted estimator. Poststratification variables that are more closely related to household income should be considered for the NHES estimation phase, and the use of tenure in addition to or in place of some of the other poststratification variables may be useful in this respect. For estimation of 3- to 5-year-olds in the NHES, the poststratified estimator appears to perform reasonably well for the range of statistics available, and it is recommended for use with this target population. Problems concerning undercoverage bias due to households without telephones were not substantial. Fourteen tables and eight figures present field test findings. An appendix discusses the source and reliability of estimates. (SLD)

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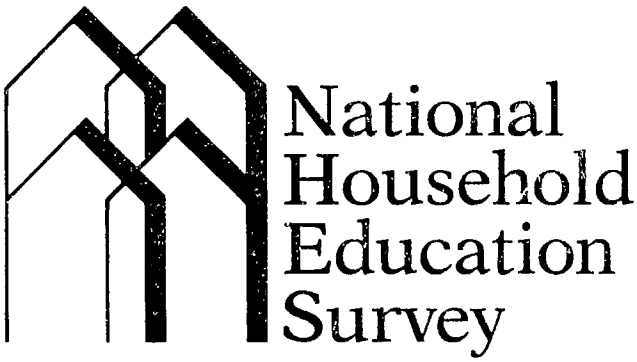
Technical Report July 1992

National Household Education Survey

Technical Report No. 2

Telephone Undercoverage Bias of 14- to 21-year-olds and 3- to 5-year-olds

Contractor Report



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Foreword

The National Household Education Survey (NHES) represents a major new initiative of the National Center for Education Statistics (NCES). Between February and May of 1991, the NHES was fielded for the first time as a mechanism for collecting data on two different sectors of education policy interest: the early childhood education experience of young children and participation in adult education. Because the NHES methodology is relatively new and relies on some innovative approaches, a field test of the methodology was an essential first step in the development of the survey. Many of the methods of evaluated during the 1989 NHES field test were adopted for the full-scale survey.

A large field test of approximately 15,000 households was conducted during the fall of 1989. A number of methodological issues associated with collecting and analyzing data on education issues from a random digit dialing telephone survey were examined. This report is one of five that describe the 1989 NHES Field Test experience. The five reports are the first in a series of technical publications pertaining to the design and conduct of the NHES that NCES hopes to continue in the years to come. NCES believes that the reports contained in this series will provide users of the NHES data with a better understanding of the NHES methodology and that they will assist the survey design efforts of others.

The first report in this series, *Overview of the National Household Education Survey Field Test*, describes the design of the field test and the outcomes of the field test data collection activities. It reports on the response rates obtained, both unit and item, and the burden associated with survey participation. Each of the next four reports in the series focuses on a specific issue that was examined in the 1989 NHES field test.

The second report, *Telephone Undercoverage Bias of 14- to 21-Year-Olds and 3- to 5-Year-Olds*, analyzes data from the Current Population Survey to identify the extent of telephone coverage for two distinct populations of interest and the bias associated with this type of undercoverage for estimates of school dropouts and early childhood education program participation. Methods for adjusting survey estimates to partially reduce this bias are developed and evaluated.

The third report, *Multiplicity Sampling for Dropouts in the NHES Field Test*, examines a technique that was used to increase the coverage of 14- to 21-year-olds and to capture more dropouts in the sample. The report describes the effectiveness of the multiplicity sample in achieving these goals.

The fourth report, *Proxy Reporting of Dropout Status in the NHES Field Test*, focuses on measurement errors arising from the use of proxy respondents. During the 1989 Field Test, a knowledgeable household member was used as a source of information on the school enrollment of each sampled 14- to 21-year-old in the household. In addition, 14- to 21-year-olds were asked to report on their own school enrollment. The report describes the correspondence between the responses given by proxy respondents with those provided by the youths themselves.

The fifth report, *Effectiveness of Oversampling Blacks and Hispanics in the NHES Field Test*, describes the approach used to increase the number of black and Hispanic households/youth in the sample. During the field test, an approach that uses demographic information at the telephone exchange level to develop sampling strata was used to oversample black and Hispanic households. The report examines the yield of the field test sample design versus that which would have been expected without oversampling. The effects of oversampling on the precision of survey estimates are reported.

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Critical technical review of this report was provided by NCES staff Michael Cohen, Bob Burton, Marilyn McMillen, and Jeffrey A. Owings, Branch Chief, Longitudinal and Household Studies Branch. Don Malec of the National Center for Health Statistics reviewed the report. The authors wish to thank each of these individuals for their careful reading of this report and for their comments and suggestions.

Table of Contents

List of Tables

List of Figures

Introduction

During the fall of 1989, the Field Test of the National Household Education Survey (NHES) was conducted by the National Center for Education Statistics (NCES) to explore the feasibility of collecting education data by telephone from a sample of persons in their households. The NHES is the first major attempt by NCES to go beyond its traditional surveys, which rely upon school-based data collection systems and are typically conducted by mail or in-person data collection methods.

A household survey has the potential to provide the types of data needed to study current issues in education, particularly those which can not be adequately addressed through a school-based survey. Such issues include dropping out of school, adult and continuing education, preschool education, the status of former teachers, and home-based education. Consequently, the NHES methodology may greatly enhance the scope of issues covered by the data collection activities of NCES.

Since the NHES data collection methods were untested for education surveys, the Field Test was developed to evaluate the use of this approach. Two topics of broad policy interest were included in the Field Test: the early childhood education characteristics of 3- to 5-year-olds, and the educational status of 14- to 21-year-olds with a special focus on youth who dropped out of school before completing high school. By including both of these study areas in the Field Test, the ability to use the NHES to study multiple, complex topics, employing different sampling requirements and respondent rules could be evaluated.

Westat, Inc., under contract with NCES, conducted all of the Field Test interviews using computer-assisted telephone interviewing (CATI) methods. The use of CATI methods made sampling respondents for interviews easy and nearly invisible to the telephone respondent, an important benefit when several persons may be sampled in a household. CATI also directed the interviewers through complex skip patterns and provided the opportunity to incorporate edit checks to help resolve inconsistencies in the data while the respondents were still on the telephone. Another major advantage of the use of CATI was that data analysis could begin soon after data collection ended, because data entry and many of the edit checks were done during the interview.

The sampling scheme used in the Field Test was a variant of the Mitofsky-Waksberg random digit dial (RDD) procedure[1] in which every residential telephone number has the same chance of being drawn into the sample. Because of the need for more precise estimates of blacks and Hispanics, special sampling methods were used to increase the sample size for these persons. The design for the Field Test was essentially the same as planned for a full-scale NHES study, except the overall sample size was smaller.

The sample resulted in collecting data from 15,037 households representing all civilian, noninstitutionalized persons in the 50 states and the District of Columbia. Although only persons living in telephone households could be sampled for the Field Test, adjustments were made in the weights so that the estimates of persons living in both telephone and nontelephone households could be produced.

Respondents in sampled households were asked a series of screening questions. This interview, called the Screener, was used to enumerate all the members of the household, determine the eligibility of each person in the household for the early childhood education (3- to 5-year-olds) and youth (14- to 21-year-olds) studies, and obtain some data on the characteristics of the household. A total of 4,374 households had at least one person enumerated in the Screener who was eligible for an extended interview. The response rate to the Screener was 79 percent.

The early childhood education interview was conducted with the parent or guardian who knew the most about each sampled 3- to 5-year-old child's care and education. Accordingly, this interview was called the Parent Interview. Of the 1,551 children identified in the Screener, parents completed interviews for 1,530 children, a completion rate of 99 percent.

If the household contained any 14- to 21-year-olds, then a Household Respondent Interview (HRI) was attempted for each of these members. The HRI was used to determine the current and previous educational status of the youth; this interview could be completed by any adult household member who knew about the educational activities of the youth, including self-reports by the youth. Of the 4,441 youths identified in the Screener, HRIs were completed for 4,313 youths, for a 97 percent completion rate. As part of a special methodological study of multiplicity sampling, mothers in a

subsample of the households were asked to complete the HRI for their 14- to 21-year-old children who did not live in their household. These youth are included in the numbers stated above.

A Youth Interview (YI) was then attempted for a subsample of the 14- to 21-year-olds in the household. All the youths who were not currently enrolled in school and did not have a high school diploma or equivalent (as reported in the HRI), and a sample of all other youths, were targeted for the YI. The interview contained more detailed items on the educational experiences of the youth that could only be answered by the youth. Of the 1,863 youths sampled, 1,604 completed the YI, a completion rate of 86 percent. These numbers include a sample of 133 youths who did not live in the sampled households, but were included through the multiplicity sample when their mothers completed the HRI.

This report describes research conducted prior to the Field Test data collection. The research involves the examination of the issues of telephone coverage for the two populations sampled for the Field Test. The Field Test is described in another report entitled *Overview of the National Household Education Survey Field Test*, the first in a series of reports on the Field Test. The Overview Report describes the sample design, the data collection methods and instruments, the response rates, and other salient aspects of the collection and analysis process for the Field Test.

This research was conducted to understand important methodological issues that could not be directly addressed from data collected in the NHES Field Test. An important concern for any survey is the completeness of the survey in terms of covering the target population. Every household survey is subject to some undercoverage bias, the result of some members of the target population being either deliberately or inadvertently missed in the survey. The discussion of the undercoverage bias in the decennial Census of Population is one well-known example of this problem. A general discussion of the problems of undercoverage with references to the literature is Madow, Nisselson, and Olkin.[2]

Telephone surveys like the NHES are subject to an additional source of bias because only about 93 percent of all the households in the United States have a telephone. Even more problematic is the fact that the percentage of households without telephones varies from one subgroup of the population to another. Massey and Botman[3] discuss this problem in some detail.

Since presence of a telephone in a household is correlated with variables such as income, education, and household size, it is very likely that estimates of dropping out of school and early childhood educational experiences are affected by this source of bias. Because of uncertainty on how this variability affects statistics to be gathered in NHES, a special analysis of the bias associated with telephone coverage and its potential impact on estimates from the NHES was conducted.

This report examines the telephone undercoverage issue for the 14- to 21-year-old and the 3- to 5-year-old populations separately. The research was completed prior to the NHES Field Test using existing data from surveys conducted by the Census Bureau. For each population, the estimates of the magnitude of the bias associated with the telephone undercoverage are examined first. Then methods for adjusting the estimates to partially reduce this bias are proposed and evaluated. Recommendations for estimation strategies are proposed for each of the populations.

Source of Data for Analysis

Each October a supplement (the Education Supplement) to the monthly *Current Population Survey* (CPS) is conducted by the Census Bureau. Among the supplemental questions are items on the current and previous years' school enrollment and high school graduation status. These items are available on the October public-use file released by the Census Bureau. Data on which of the sampled households in the CPS have telephones are also collected, although this data item was not included in the October public release file prior to 1989.

To construct the data base for the telephone undercoverage analysis, we merged the telephone status information from the November public-use file onto the Education Supplement data from the 1988 October public-use file using a unique household identifier common to both files. A feature of the CPS sample design is that a portion of the household sample is rotated in or out of the survey from one month to the next. For any two successive months about 75 percent of households overlap by design and about 71 percent of households actually overlap after

accounting for nonresponse and persons who moved in either of the two months.

In the analysis which follows using the merged October and November data, we have compensated for the reduction in sample size by inflating the weights used in estimation to weight back up to the fully-aggregated October estimate. The factor used to inflate the weights to account for the reduction in sample size is the ratio of the estimated October total population (either of 14- to 21-year-olds or of 3- to 5-year-olds) to the corresponding estimated total population remaining on the merged October and November file. The comparison of the estimated number of persons, by age, from the merged file with the totals from the complete October file indicates that the use of the merged file does not significantly distort the estimates.

In a preliminary stage of the analysis, the 1987 October and November public-use files were merged. Some analyses were conducted using the merged 1987 files, and the findings of these analyses suggested several approaches to reduce the size of the bias. To evaluate these approaches, the 1988 public use files were merged and used for the analysis described in this report. The method used to define some dropout characteristics for the 14- to 21-year-old population in the 1988 merged file was slightly revised for the 1987 analysis file. All of the results reported are from the 1988 file, unless otherwise noted.

Although there are many variables included in the analysis, the telephone status of a household is obviously the most critical data element. The data element which indicated if a telephone was present in a household was missing for less than 0.5 percent of the records in the November public-use file. Tabulations were made to compare the estimated total populations to the sum of the estimated telephone and nontelephone household populations. The estimated total population was greater than the sum of the two estimated components by less than 0.5 percent. The difference was mainly due to missing data on the telephone status variable. This level of missing data does not have an important effect on the estimates of coverage for the populations of interest.

The procedure used to analyze the extent and impact of telephone coverage in the two NHES Field Test topic areas is to compare the statistics from the CPS for all households to the same statistics based only on the sample from households with telephones. Different estimation schemes were devised to adjust the estimates from the sample of telephone households to approximate the estimates from all households.

The analysis described below focuses on potential biases of telephone surveys arising from incomplete telephone coverage. It does not include other sources of sampling and nonsampling error. The CPS is itself a sample survey and subject to both of these types of errors.

One important source of nonsampling error in the CPS is coverage, although not telephone coverage since the CPS is conducted in-person whenever no telephone is available in the household. (The first CPS interview is always conducted in-person; subsequent interviews may be conducted by telephone if the respondent is willing and a telephone is available.) The CPS coverage problem is most severe for males between 19 and 24 years old and for blacks and Hispanics[4]. These nonsampling errors pose additional problems for estimating characteristics for these subsets of the population.

Another type of nonsampling error that arises in both telephone and in-person interviews is the incomplete coverage of household members. Research conducted by Maklan and Waksberg[5] indicates that within-household coverage is no worse for telephone surveys than it is for in-person surveys.

Undercoverage Bias in Estimates of 14- to 21-Year-Olds

The problem associated with telephone coverage for 14- to 21-year-olds, especially those who left high school without a diploma, is probably more severe than it is for any other major population subgroup of interest to education policymakers. The analysis of the problem begins with the presentation of basic estimated totals, dropout rates, and telephone coverage rates. After displaying the nature of the problem, there are presentations of alternative estimators that could be used for the NHES, estimates of the magnitude of the bias associated with each estimator, and recommendations for implementation.

First, a brief definition of terms is necessary. For this analysis, persons were categorized into groups by their enrollment status in the current year and the previous year. Four categories of enrollment status are used: all persons,

those enrolled in school last year, status dropouts, and event dropouts. The categorization is not exclusive; a person can fall into more than one category. First, the two types of dropouts are defined. This is followed by a definition of those categorized as being in school last year in the context of the definitions of dropouts.

A status dropout is defined as a 14- to 21-year-old who was not enrolled in school in October of the current year and did not have a high school diploma or equivalent. Event dropouts are defined as the subset of status dropouts who were enrolled in school in October of the previous year. In other words, a status dropout is someone who is not currently enrolled and does not have a diploma or equivalent, and an event dropout is a status dropout who left school within the last year.

Dropout rates can be computed for each of these two types of dropouts. The status dropout rate is defined as the ratio of the estimated number of status dropouts to the estimated number of all 14- to 21-year-olds. The event dropout rate is defined as the ratio of the estimated number of event dropouts to the estimated number of 14- to 21-year-olds who were enrolled in school the previous October. This denominator is used because, in order to be an event dropout, the person had to be enrolled in school the previous October.

The estimate of the denominator of the event dropout rate had to be constructed from other variables because the necessary data for a direct estimate were not available in the public release files.[6] The denominator, the number of 14- to 21-year-olds in school last year, is defined as the number of persons enrolled in school in the previous year who did not graduate from high school prior to the current year. For example, a person who was enrolled in 1987 but had graduated before 1988 was excluded from the denominator, assuming the person was enrolled in postsecondary education in 1987. The exclusion attempts to eliminate those enrolled in higher education in the previous years.

Telephone Coverage for 14- to 21-Year-Olds

The CPS estimates of the number of 14- to 21-year-olds living in telephone and nontelephone households in October 1988 are shown in table 1. The table presents the estimates for several different reporting categories depending upon the person's or household's characteristics. Table 2 presents the status and event dropout rates for the corresponding populations. Totals and rates are both given because telephone coverage may affect these statistics differently.

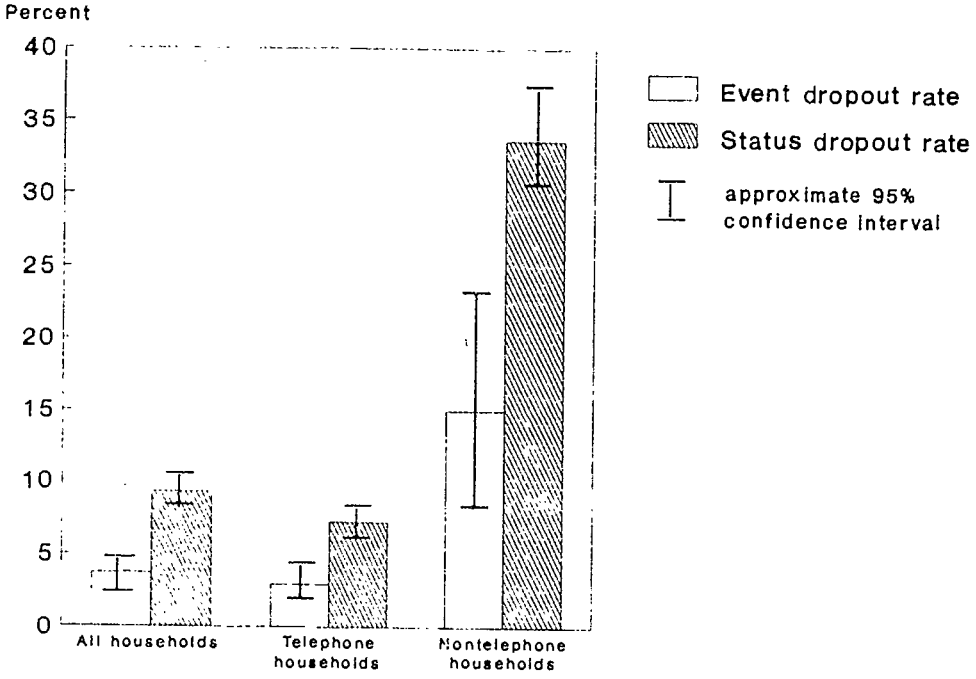
The estimates in tables 1 and 2 are presented to describe the basic problems associated with restricting the NHES to households with telephones and as the foundations for other types of estimates, such as the telephone coverage rate. (For complete reporting of dropouts statistics, see the NCES report by Frase.[7]) As described in the previous section, estimates in this report are subject to sampling errors, and these sampling errors can be approximated using the procedures described in appendix A.

These tables show very large differences in dropout rates between telephone and nontelephone households. Both the status and the event dropout rates in nontelephone households are over four times as large as in telephone households. Figure 1 displays these relationships graphically, including approximate 95 percent confidence intervals. A large difference between the estimates of the characteristics of persons living in telephone and nontelephone households is one of the two conditions necessary for producing a significant bias in a survey restricted to telephone households. The other condition is having a substantial portion of the population excluded from the survey because of the absence of a telephone in the household.

The telephone coverage rate is the estimated percentage of 14- to 21-year-olds, status dropouts, or event dropouts who live in households with telephones. The estimated coverage rates for October 1987 and October 1988 are given in table 3. The overall coverage rate for all 14- to 21-year-olds is about 91 or 92 percent, which is very close to the 93 percent quoted for the entire population. For the subgroup of students who were enrolled in school last year the coverage is even better, 94 percent.

The coverage rates for persons classified as either status or event dropouts in both 1987 and 1988 are much lower, with rates varying between about 70 and 80 percent. The estimated telephone coverage rate for status dropouts is approximately 70 percent in both 1987 and 1988. The estimated event dropout coverage rate is 75 percent in 1988 and 81 percent in 1987.

Figure 1. -- Estimated dropout rates by telephone status for 14- to 21-year-olds in October 1988



Source: Special tabulations of the 1988 October and November CPS

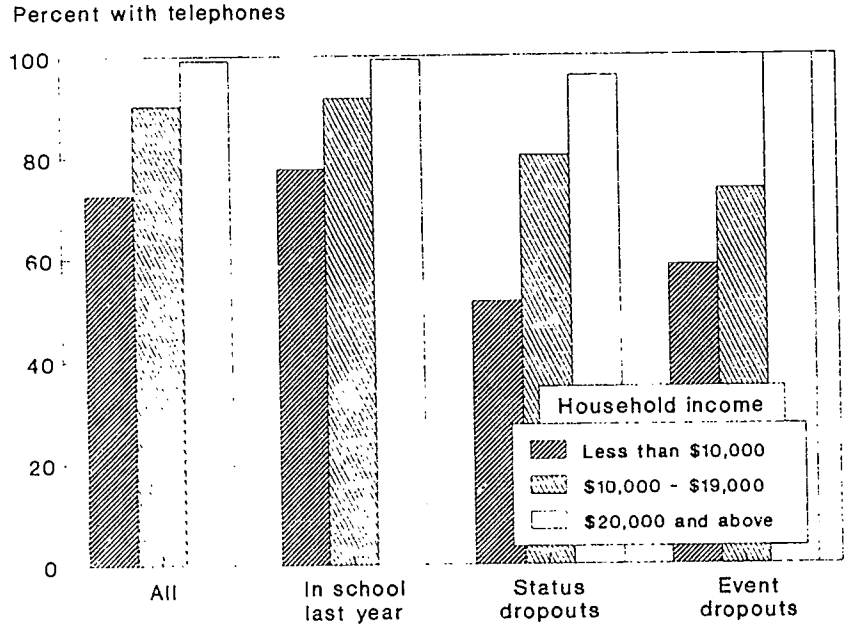
Figure 2 displays the estimated 1988 coverage rates by household income and tenure (whether the person's home is rented or owned). The graphs demonstrate that the coverage rates vary by the person's or household's characteristic as well as by enrollment status. [The telephone coverage for status dropouts (the subgroup with the lowest overall coverage) who live in homes that are owned (85.4 percent) is greater than the telephone coverage rate for renters, irrespective of enrollment status (83.7).]

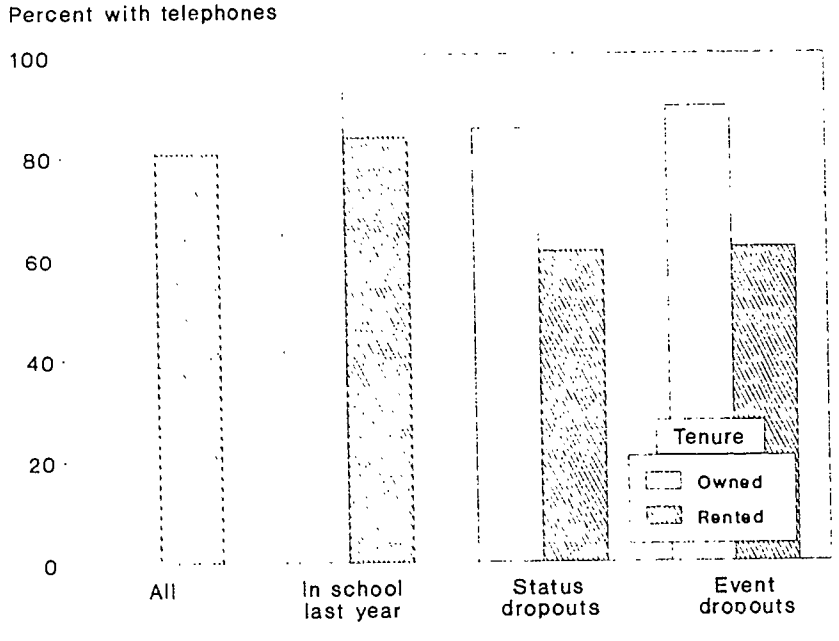
The estimated telephone coverage rates shown in figure 2 (and given in table 3) for 14- to 21-year-olds are subject to sampling errors. A summary description of the size of these sampling errors is useful for evaluating the reliability of the differences described. For all 14- to 21-year-olds and those enrolled in school last year, the approximate standard error of the estimated telephone coverage rate is typically less than 1 percent. For the telephone coverage estimates of status dropouts and event dropouts, the approximate standard errors of the estimates are typically 2 percent and 5 percent, respectively. Additional detail on the reliability of survey estimates is provided in appendix A.

These estimates indicate two important findings. First, there are large differences in the enrollment status characteristics between those in telephone and nontelephone households. Second, the telephone undercoverage rate is large and varies by the characteristics of the person or household as well as by enrollment status.

The implication is that simple estimates of the number of dropouts and the dropout rates based on a telephone household sample are anticipated to be significantly less than an estimate of the same quantity if nontelephone households were also represented. The effectiveness of simple and alternative estimation procedures in reducing these biases is discussed in the next two sections.

Figure 2. -- Estimated telephone coverage rates by selected characteristics for 14- to 21-year-olds in October 1988





Source: Special tabulations of the 1988 October and November CPS

Estimation Schemes for 14- to 21-Year-Olds

As noted earlier, there is some degree of noncoverage bias associated with all telephone surveys, not just telephone surveys trying to estimate enrollment status or dropout rates. In preparing weights for estimation, a typical procedure is to calculate base weights which reflect the probabilities of selection for each individual respondent, and then to adjust the weights for the estimated undercoverage and other forms of nonresponse.

The simplest adjustment for lack of telephone coverage is to multiply the estimation weights of the telephone households by a constant to bring the estimate up to the total for the entire population. Since the overall coverage rate for the population of 14- to 21-year-olds is 91.8 percent for 1988, the simple adjustment estimator is the base estimation weight multiplied by 1.09, the inverse of 91.8 percent. Obviously, better estimation schemes are available, but their basic method serves as a reference.

Poststratification, forcing the estimates from the survey to match known population totals for subdomains from a presumably more accurate independent data source, is often a better method to make these adjustments. See Holt and Smith[8] for a discussion of the usefulness of poststratification. One of the rationales for using poststratification is that it may reduce undercoverage bias. If the persons in a poststratification cell are homogeneous with respect to the characteristics of interest, then the poststratification can reduce the bias in the estimates and sometimes even reduce the sampling variability of the estimates.

The poststratification scheme that we investigated involved 96 adjustment cells defined by age: 14, 15, 16, 17, 18, 19, 20, and 21; crossed with race/ethnicity: Hispanic, non-Hispanic black, non-Hispanic non-black; crossed with highest grade attended by the head of household: grade 8 or less, grades 9, 10 or 11, grade 12, any postsecondary education. The average number of persons in telephone households in the adjustment cells is about 110. For almost all cells the size exceeds 20 persons, but in five of the 96 cells the cell size is less than 10 (the minimum being 6 persons in one cell).

The variables that were available for poststratification were: age, sex, region, education level, tenure, family income, family size, and family type. Age and race/ethnicity are variables used in the poststratification of the CPS to independent totals. Preliminary investigations were conducted and variables such as sex and region were determined to have little effect on reducing the bias. The variables chosen and the number of poststratification cells used was a compromise between the power of the variables to reduce the bias in estimates and the increase in variance associated with using too many cells. The 96 cells were chosen with the objective of having as many cells as possible while maintaining at least 20 cases in almost all cells.

Two sets of weighted cell totals were produced, the first using the entire analysis file (telephone and nontelephone households), the other using the telephone household data alone. Poststratification factors were computed cell by cell, by dividing each telephone household estimate into the corresponding full analysis file estimate. A final poststratified estimation weight was then computed for each 14- to 21-year-old in a telephone household by multiplying the CPS telephone file weight by the poststratification factor corresponding to the appropriate cell.

The reduction in bias due to poststratification depends on the statistic under consideration and the population subgroup to which it applies. For estimates of the number of status dropouts or event dropouts, the reduction in bias will be substantial, often 60 percent or more for estimates of event dropouts and 45 percent or more for status dropouts, depending on the subgroup. For other statistics, such as dropout rates, the improvement is far less.

Up to this point, all the analysis had been performed on the 1987 merged file, but it was clear that the simple adjustment and the proposed poststratification estimation schemes were not adequate for producing reasonably accurate estimates of the number of dropouts or the dropout rate for a given year. The accuracy of estimates of year-to-year changes in the dropout statistics, which are presumably not subject to as large a bias as the estimates of the current level, was not evaluated.

New approaches to the estimation of the characteristics of dropouts were suggested by this preliminary analysis of the 1987 merged data. The new procedures were implemented using the 1988 data, and are defined below. In order to adequately describe these new approaches, it is useful to present

the estimation formulae for both the simple adjustment estimator and the poststratified estimator.

The simple adjustment estimator can be written as

$$\hat{y}_{simp} = \sum_i \frac{P}{T} w_i y_i \qquad (3.1)$$

where

P = the estimated number of all 14- to 21-year-olds in CPS;

T = the estimated number of 14- to 21-year-olds in telephone households in CPS;

w_i = the base weight of person i (a 14- to 21-year-old i in a telephone household); and

y_i = the characteristic of person i.

In the application of this estimator to NHES, the denominator of the adjustment factor, T, would be replaced by the estimated number of persons in telephone households as estimated from NHES. The appropriate estimation equation is then

$$\hat{y}_{simp} = \sum_i \frac{P}{\sum w_i} w_i y_i \qquad (3.2)$$

The equation for the poststratified estimator is very similar, except the adjustment factor is created for each poststratification cell. The equation for use in the NHES is

$$\hat{y}_{ps} = \sum_c \sum_i \left(\frac{P_c}{\sum_i w_{ci}} \right) w_{ci} y_{ci} \qquad (3.3)$$

where the only new notation is the subscript c which denotes poststratification cell c.

As noted above, the basic assumption underlying the poststratification adjustment is that within each poststratification cell, the covered and noncovered populations have the same mean value for the characteristic being estimated, or more broadly, the characteristic has the same distribution in the two groups. The analysis suggests that the means for these two populations are not equal and, therefore, the basic distributional assumption of poststratification does not apply for the poststratification scheme thus far investigated for the NHES.

An alternative procedure that we studied is to use the CPS October supplement to develop differential adjustments within each of the poststratification cells based upon other characteristics of the persons. This procedure is *not* a poststratification scheme with smaller adjustment cells because the estimates are not forced to equal the within-cell totals from the CPS.

The use of a smaller cell poststratification scheme was not examined for several reasons. First, poststratification based upon cells with small sample sizes tends to inflate the sampling errors of the estimates rather than reduce them. This increase in variance can be substantial. Second, the independent poststratification totals are supposed to be known, or at least subject to much less variability than the survey estimates. When small poststratification cells are used, the cell totals derived from the CPS are subject to relatively large sampling errors. Finally, additional bias may be introduced into the estimates if the survey estimates of the characteristics used to form the smaller cells do not exactly correspond to the estimates from the CPS.

The alternative approach adopted for this analysis was to compute the ratios of the number of all persons to persons in telephone households from the 1987 data for critical enrollment status categories within each of the 96 poststratification cells and then use these ratios to adjust the weights from the 1988 data. By using the 1987 data to define the cells and prepare the adjustment factors applied to the 1988 data, the possibility of overestimating the effectiveness of the procedures was avoided.

Up to three adjustment categories were created for each poststratification cell consisting of whether the person was enrolled in school, was not enrolled and had a diploma, or was not enrolled and did not have a diploma. This variable is called "INSCHOOL."

Because the ratios varied considerably and were based upon small sample sizes for many cells, a smoothing technique was used to reduce the consequences of the variability of the ratios. An empirical Bayes procedure suggested by Efron and Morris[9] was used to smooth the ratios by single year of age and adjustment cell variables.

The estimation equation for the within-cell poststratified adjustment estimator is the same as the

ordinary poststratified estimator except that within each poststratification cell the base weight is adjusted by a ratio depending on the category of INSCHOOL. The equation is

$$\hat{y}_{within}=\sum_c \sum_j \sum_i \left(\frac{P_c}{\sum_j \sum_i w_{cji} r_{cj}} \right) w_{cji}\ r_{cj}\ y_{cji} \qquad (3.4)$$

where r_{cj} is the ratio adjustment and j denotes the INSCHOOL category. This estimator is referred to as the within-cell adjusted poststratified estimator. Slight modifications of this estimator could be considered, such as using a 3-year average of the adjustment factors from the CPS. It is also reasonable to assume that this type of estimator would be updated annually.

Another estimator was considered because of the concern that the within-poststratification cell adjustment ratios might still be so variable as to increase the variability of the estimates. A mean of the adjustment cell ratios was developed across all the poststratification cells within a single year of age and INSCHOOL value. The equation for the mean adjustment estimator is identical to the within-cell poststratified adjustment estimator, except the ratios are constant within groups of poststratification cells in a single age. The equation is

$$\hat{y}_{mean}=\sum_c \sum_j \sum_i \left(\frac{P_c}{\sum_j \sum_i w_{cji} r'_{cj}} \right) w_{cji}\ r'_{cj}\ y_{cji} \qquad (3.5)$$

where the prime on r (r′) indicates that it is the mean across poststratification cells within a single year of age and value of INSCHOOL. This estimator is referred to as the mean adjusted poststratified estimator.

The mean adjusted and the within-cell adjusted poststratified estimates are not fully satisfactory in the sense that they use adjustment factors derived from historical (the previous year) data. An estimator based upon raking NHES data to marginal totals from the CPS is an alternative estimation scheme that could be considered. The raking estimator was not included in this study because these computations were completed before the Field Test had finished data collection. The raking estimator could not be evaluated until data collection was completed and the comparability of the characteristics estimated from the different surveys could be conducted. Based on the data collected in the Field Test, some general comments on the raking estimates with applications to the estimates of dropouts are possible. These comments are included in the section on recommendations.

Comparison of Estimates

Estimates of the characteristics of 14- to 21-year-olds were computed using each of the four estimation schemes described above. The estimates were then divided by the estimated total derived from the regular CPS estimate, which is the sum of the estimates of those living in telephone and nontelephone households. If the estimate is identical to the regular CPS estimate, the quotient should be unity. The quotients were multiplied by 100 in order to simplify the exposition. The ratio for each of the four estimators can be expressed as

$$R_k=100\ \frac{\hat{y}_k}{\hat{y}_{cps}} \qquad (3.6)$$

where k indicates the estimator used (simple adjustment, poststratified, mean adjusted poststratified, and within-cell adjusted poststratified), and the CPS in the denominator denotes the sum of the CPS estimates for the persons in telephone and nontelephone households.

The ratios for estimates of totals are given in table 4. The same process was followed to produce ratios for estimates of dropout rates and these are given in table 5. A ratio of 100 indicates that the estimate is exactly equal to the value of the estimate from the regular CPS. A value of less than 100 indicates that there is a residual downward bias in the estimate. Conversely, a value of greater than 100 indicates that the estimator has overcompensated for telephone coverage bias and there is a residual upward bias in the estimate.

The ratios for estimates of both totals and rates are provided because of the possibility that the estimation process might affect the two types of statistics differentially. In fact, estimates for totals might be worse under some estimation schemes which improve the estimates for rates. As shown in the tables, this situation does not arise in the proposed estimation schemes.

Because there are so many values to examine in the tables, summary statistics and histograms of the key statistics have been produced to help in the analysis. Table 6 summarizes the values of the estimates of the ratios of totals appearing in table 4. In estimating totals for the number of status dropouts and the number of event dropouts, the ratios indicate that the simple adjustment estimator is very poor (a downward bias of over 20 percent). This finding agrees with the original analysis of the 1987 CPS data.

The adjusted poststratified estimators perform much better for event and status dropout estimates than those that rely only on poststratification. The average for the ratios of the mean adjusted estimator are slightly closer to 100 than is the within-cell adjusted estimator. The variabilities for the within-cell adjusted estimators (as measured by the standard deviation and range) do not exceed those of the mean adjusted estimators. It should be noted that, since the values of the estimates in table 4 are not independent, the standard deviation and ranges are used simply to give some idea of the spread in the values.

There are two reasons which might explain why the estimates of the status dropouts and status dropout rates might be improved by the alternative estimation procedures more than the estimates for the event dropouts and event dropout rates. First, there are more status dropouts than event dropouts and more persons in the denominator of the status dropout rate than in the denominator of the event dropout rate. Because of the increased size the estimates of status dropouts are more stable, especially from year to year.

Second, the rotation scheme used in the CPS means that about half of the sample is repeated in 1987 and 1988. For the merged October and November files of 1987 and 1988 about one-third of the sample should be common to both years. Many of the persons who are status dropouts in 1987 will still be status dropouts in 1988. Since one-third of the sample overlaps between the two years, a fair correlation over time may improve the stability of the ratio adjustments for the status dropout more so than the event dropouts.

The summary statistics for the ratios of the rates from table 5 are given in table 7. The simple adjustment and the poststratified estimators again perform very poorly. The mean adjusted and the within-cell adjusted estimators are close to 100. The mean adjusted estimator is marginally closer to 100 for the event dropout rates, and the within-cell adjusted estimator is marginally closer to 100 for the status dropout rates. Once again there is no indication of an increase in the variability in the ratios for the within-cell estimator as compared with the mean adjusted estimator.

Figure 3 is a series of histograms of the values of the ratios of the estimated dropout totals from table 4. Looking down the page from the histogram of the simple estimator to the adjusted poststratified estimators shows the movement of the estimates to being more centered about the value of 100 and also more concentrated about the mode. Figure 4 shows the histograms for the values of the ratios of the estimated dropout rates from table 5. The conclusions from this figure are consistent with those from figure 3.

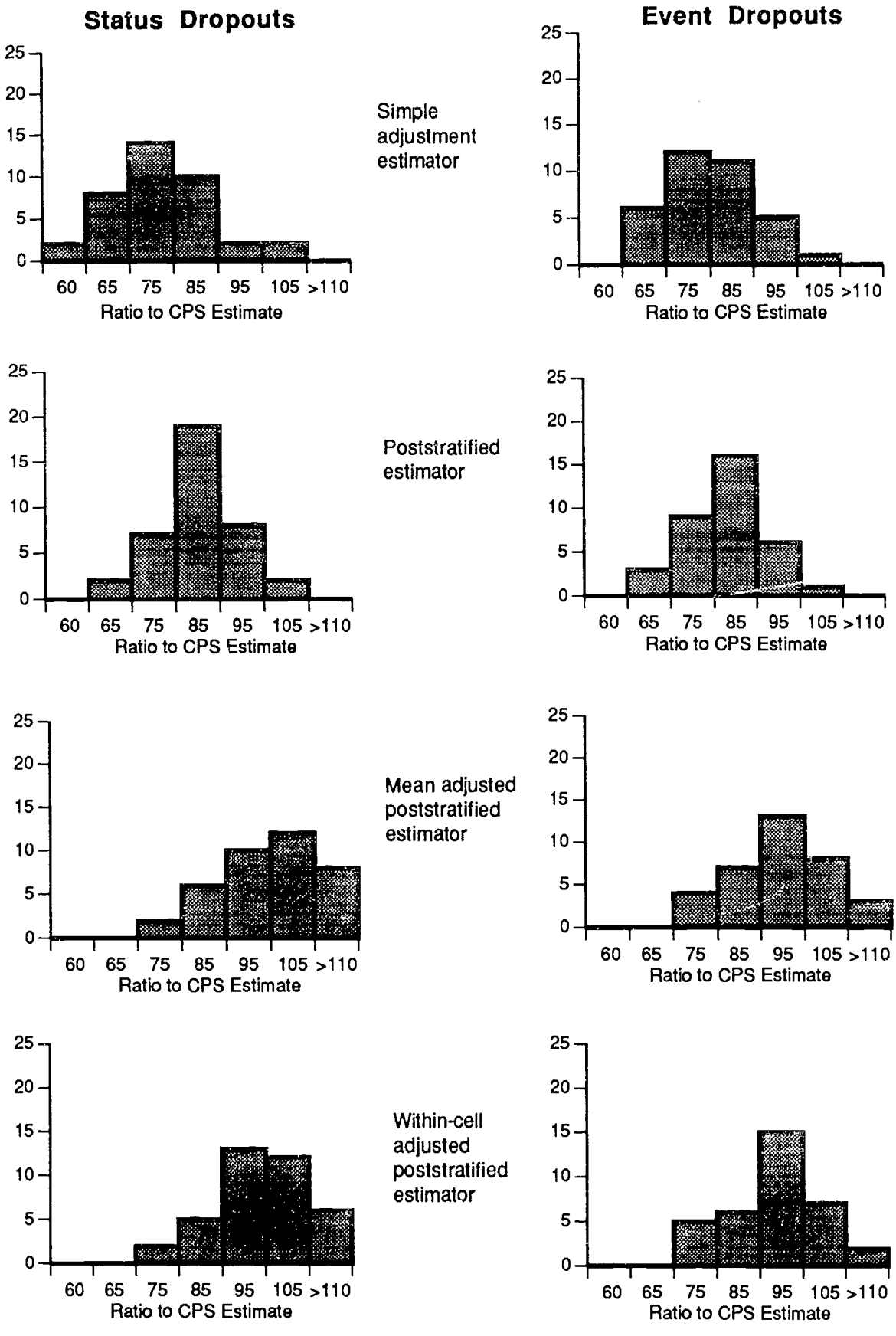
Despite the good performance of the adjusted estimators, it should be noted that they consistently overestimate the number of dropouts and the dropout rates for an important component of the population, those persons in households with incomes above $20,000. This result suggests that different poststratification cells which incorporate income levels more directly should be considered for the NHES.

Recommendations for Estimation of 14- to 21-Year-Olds in NHES

The improvements in the estimates for dropout statistics based upon the adjusted poststratified estimators are substantial. There is little evidence to suggest that either of the two adjusted poststratified estimators is better than the other, based on the analysis of the 1988 CPS data. The recommendation is to use the mean adjusted poststratified estimator because it incorporates an additional smoothing over the within-cell adjusted estimator.

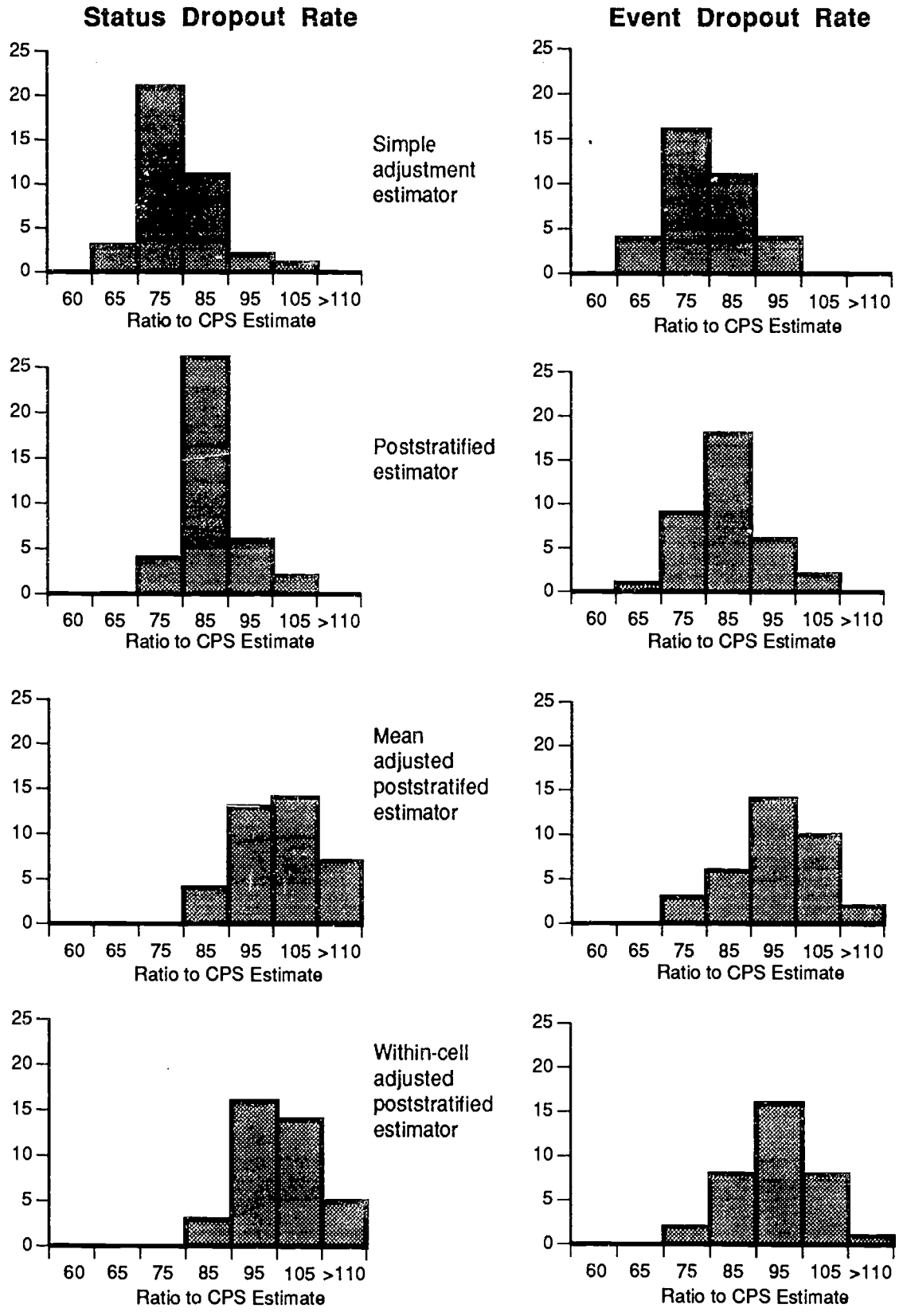
The analysis also suggests that poststratification variables that are more closely related to household income should be considered for the estimation phase of NHES. The use of tenure either in addition to or in place of some of the other poststratification variables may be useful in this respect. Since the number of households in the Field Test was only about one-third the size of the CPS, different poststratification cells are required for the

Figure 3. – Histograms of ratios of alternative estimates to CPS estimates for dropout totals



Source: Special tabulations of the 1988 October and November CPS

Figure 4. – Histograms of ratios of alternative estimates to CPS estimates for dropout rates



Source: Spacial tabulations of the 1988 October and November CPS

Field Test.

Because of the problems associated with using historical data in adjusting the estimates from a sample survey, an alternative estimation scheme using raking rather than poststratification may be preferred. By raking NHES estimates to CPS totals, we may accomplish the same gains as shown by the adjusted poststratification methods and also take advantage of the bias reducing potential associated with variables such as income. The raking estimator fits into already established sampling theory and this has obvious advantages.

Further research on the raking estimator can be undertaken based on estimates from the Field Test of the NHES. One important consideration for raking is that the estimates from the survey must be consistent with those from the independent data source (CPS, for example). The analysis of the Field Test data shows that the enrollment characteristics could be used in raking since the estimates from both sources are consistent. This finding suggests that the different data items used in the two surveys do not cause significant variability in these estimates. Therefore, raking NHES estimates to CPS estimates of enrollment status may be very beneficial. Of course, other factors including sample size and the stability of the CPS estimates must also be considered when raking is proposed.

Another area of research that might be considered is the impact of the poststratification and bias adjustments to estimates of change over time. If the NHES is structured as a periodic survey on the same topics, the estimates of change may be as important or more important than estimates of current level. Additional research into the relationship between the estimation scheme and measures of change could be important in these circumstances.

Undercoverage Bias in Estimates of 3- to 5-Year-Olds

The extent of the bias arising from the lack of telephone coverage for estimating education-related characteristics of 3- to 5-year-olds was not expected to be as large as the bias in estimating characteristics of 14- to 21-year-old dropouts. However, studies on telephone coverage in the United States have shown that the age group with the lowest telephone coverage is persons under 6 years old. These findings suggested that research into the biases associated with telephone coverage for 3- to 5-year-olds would be useful for NHES.

The October CPS Education Supplement does not contain many data items on persons between 3 and 5 years old. The elements in the supplement that are most pertinent to the education issues addressed by the NHES are enrollment in any type of school, enrollment in nursery school, and enrollment in kindergarten. The percentage of 3- to 5-year-olds enrolled in any type of school, nursery school, and kindergarten is computed by dividing the appropriate estimated total by the estimated number of 3- to 5-year-olds.

Telephone Coverage for 3- to 5-Year-Olds

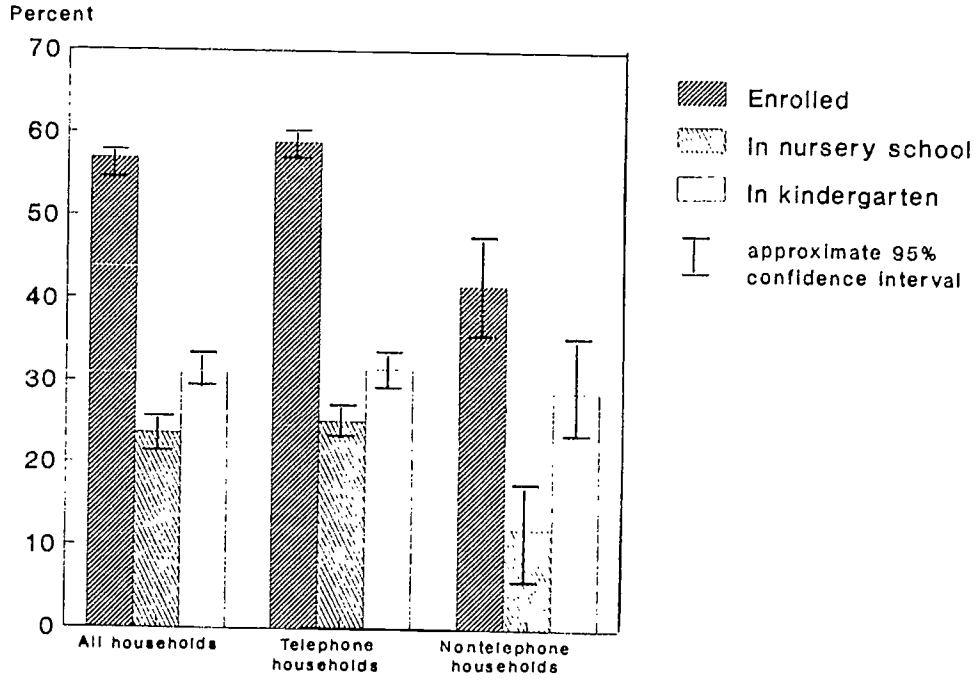
The CPS estimates of the number of 3- to 5-year-olds living in telephone and nontelephone households are shown in table 8. The table presents the estimates for many of the same reporting categories used in the earlier analysis of 14- to 21-year-olds. Table 9 shows the percent of 3- to 5-year-olds who are enrolled, enrolled in nursery school, and enrolled in kindergarten by the same reporting categories for all households, telephone households, and nontelephone households.

These tables show that the percentage enrolled, the percentage enrolled in nursery school, and the percentage enrolled in kindergarten do not vary considerably between those in telephone households and nontelephone households. The relatively consistent patterns for telephone and nontelephone households can be seen in figure 5 which gives the percentage of 3- to 5-year-olds enrolled by telephone status, along with approximate 95 percent confidence intervals. The only difference which is statistically significant is the percentage in nursery school.

As noted earlier, one of the two conditions necessary for producing a large bias in a survey restricted to telephone surveys is a sizeable difference between the estimates of the characteristics of the persons in telephone households and nontelephone households. Based upon the enrollment estimates available from the CPS, this condition does not appear to be satisfied for the characteristics of 3- to 5-year-olds studied.

The estimated telephone coverage rates for 3- to 5-year-olds for 1987 and 1988 are shown in

Figure 5. — Estimated percentage enrolled, by telephone status for 3- to 5-year-olds in October 1988



Source: Special tabulations of the 1988 October and November CPS

table 10. The overall estimated coverage rate for 3- to 5-year-olds is only about 88 percent, which is lower than the 93 percent telephone coverage rate for persons of all ages. When we examine the telephone coverage rates for enrolled 3- to 5-year-olds, it is clear that this subgroup of the population has slightly greater telephone coverage than the overall average. This situation is the converse of what was observed for the 14- to 21-year-olds. The 3- to 5-year-olds in nursery school have the highest telephone coverage rate, about 6 percent above the estimate for all 3- to 5-year-olds. The telephone coverage rate for those in kindergarten is estimated to be only slightly greater than the overall rate.

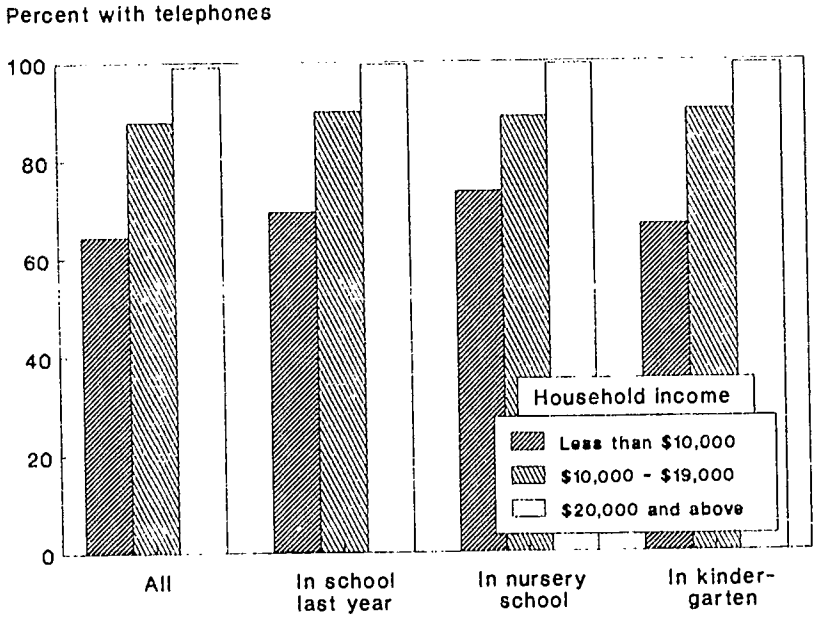
The high coverage rates for these subgroups indicate that the problems associated with bias will probably be relatively small for this population. It is possible that poststratified estimates might result in overestimates of the characteristics of interest. This possibility is remote because the coverage rates for the subgroups do not vary substantially from the coverage rates for all 3- to 5-year-olds.

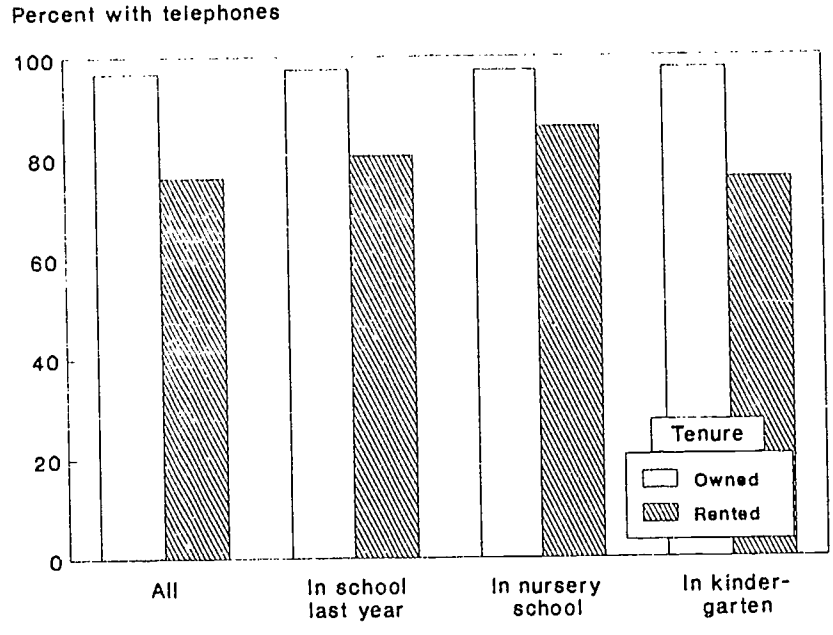
Figure 6 displays the estimated telephone coverage rates of 3- to 5-year-olds by tenure and household income. The graphs show that the telephone coverage rates vary considerably by these characteristics that are related to wealth. The graphs also show that the relationship between the percentage of households with telephones is relatively constant across the enrollment categories of the 3- to 5-year-olds.

The estimated telephone coverage rates shown in figure 6 and table 10 are subject to sampling errors. For all 3- to 5-year-olds and those enrolled in school, the approximate standard error of the estimated telephone coverage rate is typically less than 1.5 percent. For the telephone coverage estimates of those in nursery school and those in kindergarten, the approximate standard error of the estimate is typically less than 2 percent. Details on these approximations are given in appendix A.

The results from the analysis of the 3- to 5-year-old data are very different from the results from

Figure 6. — Estimated telephone coverage rates, by selected characteristics, for 3- to 5-year-olds in October 1988





Source: Special tabulations of the 1988 October and November CPS

the 14- to 21-year-old analysis. The percentage enrolled does not vary much between the persons in telephone households and those in nontelephone households. Furthermore, the estimated telephone coverage for the enrolled persons is slightly greater than the telephone coverage rate for all 3- to 5-year-olds. The estimated telephone coverage does vary considerably by the characteristic of the person or household, but does not vary much by enrollment status within the characteristic. These findings imply that a survey restricted to telephone households may not introduce large biases due to telephone undercoverage, even if relatively simple estimation procedures are used. The following sections examine the effects of various estimation schemes and the coverage bias remaining.

Estimation Schemes for 3- to 5-Year-Olds

The findings discussed above suggest that an ordinary poststratification estimator should be adequate to provide estimates of reasonable accuracy for the educational characteristics of 3- to 5-year-olds in NHES. For this reason the estimation schemes studied for this population were restricted to the simple adjustment estimator and the ordinary poststratification estimator.

The simple adjustment estimator for the 3- to 5-year-old estimates was created by multiplying the estimation weight for the telephone households by the inverse of the telephone coverage rate. The telephone coverage rate for the 3- to 5-year-olds is estimated as 0.884, so the simple adjustment estimator is the base telephone estimation weight multiplied by 1.13. The simple adjustment estimator for 3- to 5-year-olds can be written the same as equation 3.2.

The poststratification scheme used for estimating the characteristics for the 14- to 21-year-olds was also used for the 3- to 5-year-olds to make the process simpler. The poststratification scheme for the 3- to 5-year-olds involved 36 adjustment cells defined by age: 3, 4, and 5; crossed with race/ethnicity: Hispanic, non-Hispanic black, and non-Hispanic non-black; crossed with highest grade attended by the head of household: grade 8 or less, grades 9, 10 or 11, grade 12, any postsecondary education. The average number of persons in telephone households in the adjustment cells is about 110. For almost all cells the size exceeds 20 persons, but in one of the 36 cells the cell size is less than 10 (the minimum being 9 persons in one cell). The poststratified estimator can be written in the same form as equation 3.3.

The analysis of the 1987 merged file (not shown in this report) indicated that the bias associated with the lack of coverage for nontelephone households was not a severe problem, and both the simple adjustment estimator and the poststratified estimator were reasonably adequate for handling the problem. Therefore, no alternative estimation schemes were investigated for 3- to 5-year-olds for NHES.

Comparison of Estimates

The procedures used for comparing the different estimators for the 14- to 21-year-olds were also used for the two estimators for the 3- to 5-year-olds. The estimates for each of the two estimation schemes were multiplied by 100 and then divided by the estimated total derived from the regular CPS estimate, which is the sum of the estimates of those living in telephone and nontelephone households. If the estimate is identical to the regular CPS estimate, then the quotient should be 100. The ratio for each of the two estimators can be expressed as

$$R_k = 100 \frac{\hat{y}_k}{\hat{y}_{CPS}} \qquad (4.1)$$

where k indicates the estimator used (simple adjustment, or poststratified), and the CPS in the denominator denotes the sum of the CPS estimates for the persons in telephone and nontelephone households.

The ratios for estimates of totals are given in table 11. The same process was followed to produce ratios for estimates of the percent of 3- to 5-year-olds enrolled and these are given in table 12. A ratio of 100 indicates that the estimate is exactly equal to the value of the estimate from the regular CPS. A value of less than 100 indicates that there is a residual downward bias in the estimate. Conversely, a value of greater than 100 indicates that the estimator has overcompensated for telephone coverage bias and there is a residual upward bias in the estimate.

Summary statistics and histograms of the key statistics have been produced to help in the analysis. Table 13 summarizes the values of the estimates of

the ratios of totals appearing in table 11. In estimating totals for the number of 3- to 5-year-olds enrolled, the ratios indicate that the simple adjustment estimator is reasonable. The mean and median of the ratios are relatively close to 100. This finding agrees with the original analysis of the 1987 CPS data.

The poststratified estimator performs somewhat better than the simple estimator. The averages for the ratios of the poststratified estimator are slightly closer to 100 than the simple estimator. The variability for the poststratified estimator (as measured by the standard deviation and range) is also somewhat smaller than the variability of the simple adjustment estimator.

The summary statistics for the ratios of the percentage enrolled from table 12 are given in table 14. The simple adjustment and the poststratified estimators again perform well. The averages of the ratios for the poststratified estimator are closer to 100 than the averages for the simple adjustment estimator. The variability of the poststratified estimator is not clearly smaller than that of the simple adjustment estimator for these statistics.

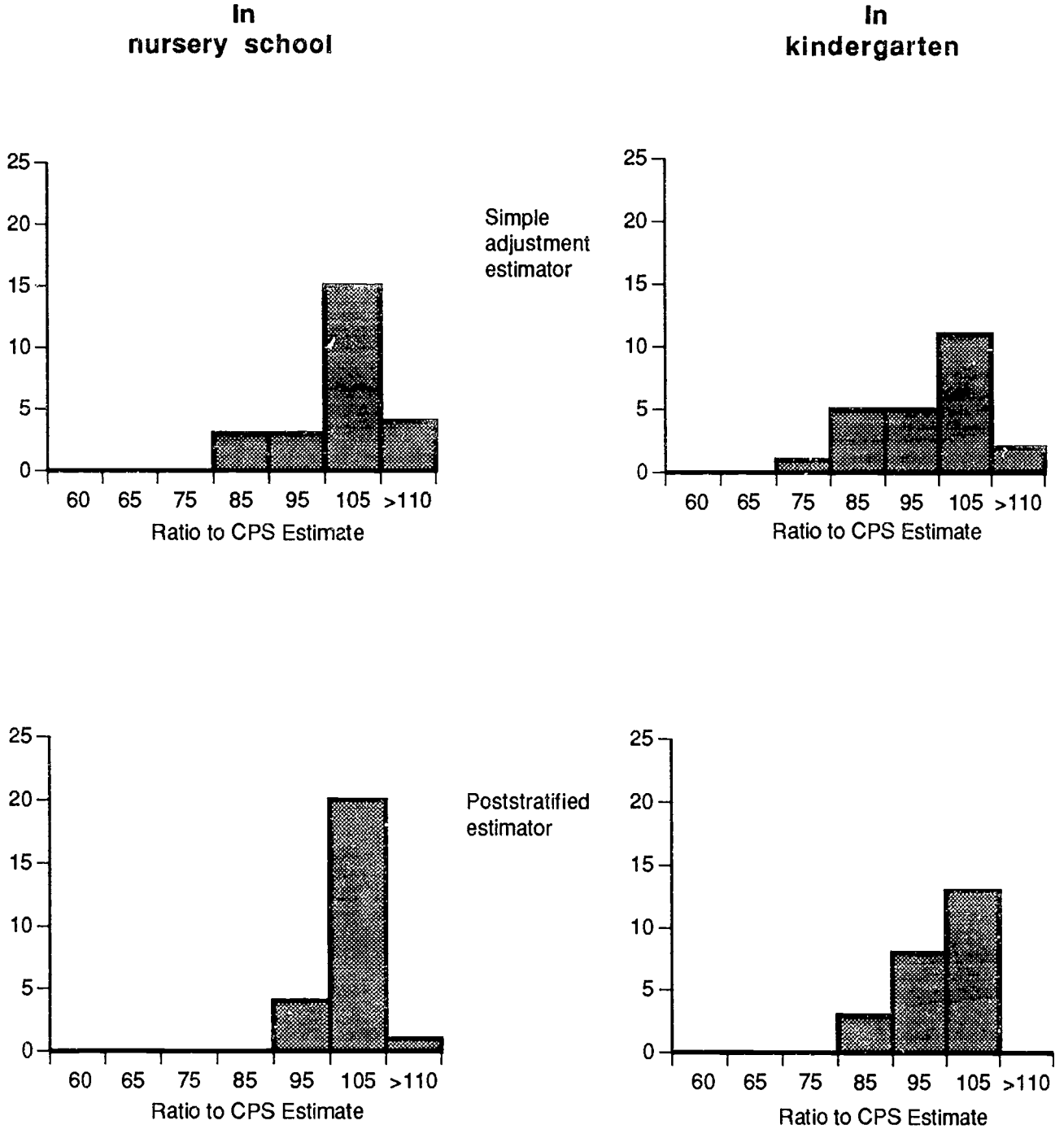
Figure 7 is a series of histograms of the values of the ratios of the estimated enrollment totals from table 11. Looking down the page from the histogram of the simple estimator to the poststratified estimator shows the slight movement of the estimates to being more centered about the value of 100 and also more concentrated about the mode. The amount of bias reduction due to the poststratified estimator is much smaller for the 3- to 5-year-old estimates than it was for the 14- to 21-year-old estimates mainly because the simple adjustment estimator does so much better for the 3- to 5-year-old estimates. This relationship can be seen by comparing the histograms in figure 3 to those in figure 7.

Figure 8 shows the histograms for the values of the ratios of the estimated percent enrolled from table 12. This figure indicates that both the simple and poststratified estimators are reasonable and differ only slightly. The poststratified estimator does slightly reduce the overestimation of the percentage enrolled which results from the use of the simple adjustment estimator, especially for number of persons enrolled in households with incomes above $20,000.

Recommendations for Estimation of 3- to 5-Year-Olds in NHES

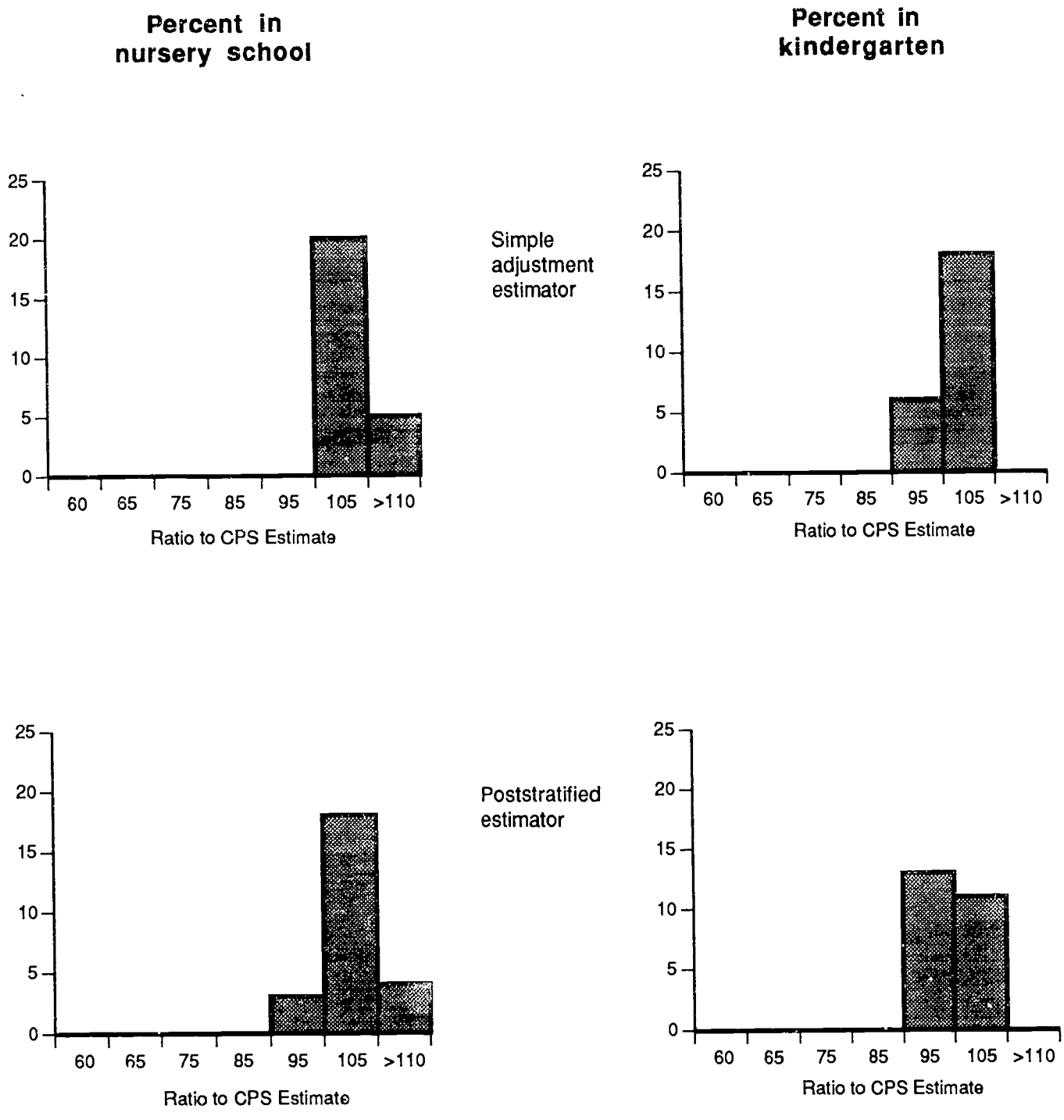
The poststratified estimator appears to perform reasonably well for the range of statistics that were available from the CPS for the 3- to 5-year-old population. The poststratified estimator is recommended for use with this target population in the NHES. The problems associated with undercoverage bias due to households without telephones do not appear to be substantial for this target population. Because of the paucity of data in the CPS on the education and care of 3- to 5-year-olds, it would be useful to consider other data sources before finalizing this analysis.

Figure 7. – Histograms of ratios of estimates to CPS estimates for enrollment totals



Source: Special tabulations of the 1988 October and November CPS

Figure 8. — Histograms of ratios of estimates to CPS estimates for enrollment



Source: Special tabulations of the 1988 October and November CPS

Table 1.—Estimated number of 14- to 21-year-olds in telephone and nontelephone households by enrollment status, October 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting category	Telephone households				Nontelephone households			
	Total	In school last year[1]	Status dropout	Event dropout	Total	In school last year[1]	Status dropout	Event dropout
	(Numbers in thousands)				(Numbers in thousands)			
Overall	25,682	15,614	1,837	455	2,301	1,030	773	154
Age								
14	3,115	3,047	24	11	212	207	1	1
15	3,033	2,947	33	11	227	212	20	6
16	3,197	3,064	128	67	216	195	43	32
17	3,499	3,274	223	126	243	180	90	37
18	3,532	2,614	389	143	299	155	135	43
19	3,092	529	355	68	320	65	164	24
20	3,058	106	318	19	397	17	169	11
21	3,154	33	368	11	387	[2]0	150	[2]0
Race								
White	21,146	12,666	1,503	357	1,615	666	629	128
Black	3,535	2,307	295	90	622	324	134	23
Other	1,000	641	40	8	64	40	10	3
Ethnicity								
Hispanic	2,212	1,290	414	56	538	189	263	46
Non-Hispanic	23,028	14,054	1,367	376	1,660	791	468	98
Sex								
Male	12,990	8,239	988	271	1,111	516	403	84
Female	12,692	7,375	849	184	1,190	514	371	71
Family income								
Less than $10,000	3,469	1,912	549	138	1,319	553	518	98
$10,000 - $19,999	6,555	3,792	706	138	715	347	176	50
$20,000 and above	14,192	9,061	483	167	121	63	21	[2]0
Household size								
1-2 persons	2,881	993	290	64	607	153	201	42
3-4 persons	14,044	8,713	895	260	1,004	429	369	48
5 or more persons	8,757	5,907	652	131	690	449	203	63

Table 1.—Estimated number of 14- to 21-year-olds in telephone and nontelephone households by enrollment status, October 1988 noninstitutionalized civilian population: 14- to 21-years old—Continued

Reporting category	Telephone households				Nontelephone households			
	Total	In school last year[1]	Status dropout	Event dropout	Total	In school last year[1]	Status dropout	Event dropout
	(Numbers in thousands)				(Numbers in thousands)			
Household type								
Husband and wife	17,909	11,320	1,027	248	929	455	313	64
Other family	6,433	4,048	696	181	1,009	507	365	79
Other type	1,340	246	114	27	363	69	96	11
Highest grade attended								
Grade 8 or less	1,383	1,096	299	45	363	189	193	22
Grade 9	3,118	2,826	281	61	377	246	160	38
Grade 10	3,655	3,240	450	112	327	176	167	23
Grade 11	3,451	3,055	469	137	366	215	193	51
Grade 12	7,130	3,934	297	101	691	186	48	18
Marital status								
Ever married	1,401	113	354	19	463	54	262	28
Never married	24,281	15,500	1,483	436	1,838	976	511	126
Region								
Northeast	5,300	3,043	361	88	295	108	114	9
North Central	6,680	4,150	371	109	462	247	119	42
South	8,316	5,246	619	171	1,150	505	389	76
West	5,386	3,175	487	86	395	170	151	27
Tenure								
Owned	18,449	11,963	831	253	565	321	143	29
Rented	7,204	3,636	998	202	1,736	709	631	125

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

NOTE: Some of the numbers do not add to the totals because of missing data and rounding.

[1]In school last year is defined as persons enrolled in October 1987 who did not graduate before October 1988.

[2]Estimate less than 1,000 persons.

Table 2.—Estimated dropout rates for 14- to 21-year-olds in telephone and nontelephone households by enrollment status, October 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting category	All households		Telephone households		Nontelephone households	
	Status dropout rate	Event dropout rate	Status dropout rate	Event dropout rate	Status dropout rate	Event dropout rate
Overall	9.3%	3.7%	7.2%	2.9%	33.6%	15.0%
Age						
14	0.8	0.4	0.8	0.4	0.7	0.7
15	1.6	0.5	1.1	0.4	8.7	2.8
16	5.0	3.1	4.0	2.2	20.1	16.7
17	8.4	4.7	6.4	3.9	37.0	20.5
18	13.7	6.7	11.0	5.5	45.1	27.6
19	15.2	15.4	11.5	12.8	51.5	37.0
20	14.1	23.9	10.4	17.4	42.6	[1] ---
21	14.6	34.3	11.7	[1] ---	38.7	[1] ---
Race						
White	9.4	3.6	7.1	2.8	39.0	19.3
Black	10.3	4.3	8.3	3.9	21.5	7.0
Other	4.7	1.7	4.0	1.3	15.9	[1] ---
Ethnicity						
Hispanic	24.6	6.9	18.7	4.4	48.9	24.3
Non-Hispanic	7.4	3.2	5.9	2.7	28.2	12.3
Sex						
Male	9.9	4.1	7.6	3.3	36.2	16.2
Female	8.8	3.2	6.7	2.5	31.1	13.8
Family income						
Less than $10.000	22.3	9.6	15.8	7.2	39.3	17.7
$10.000 - $19.999	12.1	4.5	10.8	3.6	24.6	14.3
$20.000 and above	3.5	1.8	3.4	1.8	17.0	0.0
Household size						
1-2 persons	14.1	9.2	10.1	6.4	33.1	27.8
3-4 persons	8.4	3.4	6.4	3.0	36.7	11.3
5 or more persons	9.1	3.1	7.4	2.2	29.5	14.2

Table 2.—Estimated dropout rates for 14- to 21-year-olds in telephone and nontelephone households by enrollment status, October 1988 noninstitutionalized civilian population: 14- to 21-years old--Continued

Reporting category	All households		Telephone households		Nontelephone household	
	Status dropout rate	Event dropout rate	Status dropout rate	Event dropout rate	Status dropout rate	Event dropout rate
Household type						
Husband and wife	7.1	2.6	5.7	2.2	33.7	14.1
Other family	14.2	5.7	10.8	4.5	36.1	15.6
Other type	12.3	11.9	8.5	10.8	26.4	15.8
Highest grade attended						
Grade 8 or less	28.2	5.2	21.6	4.1	53.3	11.5
Grade 9	12.6	3.2	9.0	2.1	42.4	15.3
Grade 10	15.5	3.9	12.3	3.5	50.9	12.9
Grade 11	17.3	5.8	13.6	4.5	52.7	24.0
Grade 12	4.4	2.9	4.2	2.6	6.9	9.7
Marital status						
Ever married	33.1	28.4	25.2	17.0	56.7	52.4
Never married	7.6	3.4	6.1	2.8	27.8	12.9
Region						
Northeast	8.5	3.1	6.8	2.9	38.6	8.5
North Central	6.9	3.4	5.5	2.6	25.8	17.0
South	10.6	4.3	7.4	3.3	33.8	15.1
West	11.0	3.4	9.0	2.7	38.3	15.7
Tenure						
Owned	5.1	2.3	4.5	2.1	25.2	9.2
Rented	18.2	7.5	13.9	5.6	36.3	17.6

[1]The value of the estimate was suppressed because the base was less than 50,000.

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

Table 3.—Estimated telephone coverage rates, by enrollment status, October 1987 and 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting category	October 1988				October 1987		
	Total	In school last year[1]	Status dropout	Event dropout	Total	Status dropout	Event dropout
Overall	91.8%	93.8%	70.4%	74.7%	91.2%	69.4%	81.5%
Age							
14	93.6	93.6	[2]---	[2]---	93.0	[2]---	[2]---
15	93.0	93.3	62.2	[2]---	92.2	81.4	[2]---
16	93.7	94.0	74.7	67.5	93.8	77.8	80.2
17	93.5	94.8	71.2	77.4	92.8	73.0	81.7
18	92.2	94.4	74.2	77.0	91.9	73.0	79.6
19	90.6	89.0	268.3	73.7	90.6	70.0	[2]---
20	88.5	86.5	65.3	[2]---	88.7	65.4	[2]---
21	89.1	[2]---	71.0	[2]---	86.6	61.0	[2]---
Race							
White	92.9	95.0	70.5	73.5	92.7	70.5	85.8
Black	85.0	87.7	68.8	79.9	82.9	64.1	71.7
Other	94.0	94.1	[2]---	[2]---	90.7	70.6	[2]---
Ethnicity							
Hispanic	80.4	87.2	61.2	55.2	91.4	71.5	82.2
Non-Hispanic	93.3	94.7	74.5	79.4	91.1	67.3	80.8
Sex							
Male	92.1	94.1	71.0	76.5	91.4	71.5	82.2
Female	91.4	93.5	69.6	72.2	91.1	67.3	80.8
Family income							
Less than $10,000	72.5	77.6	51.5	58.5	72.2	44.8	62.4
$10,000 - $19,999	90.2	91.6	80.1	73.5	87.7	78.6	82.9
$20,000 and above	99.2	99.3	95.9	100.0	98.3	93.7	[2]---
Household size							
1-2 persons	82.6	86.7	59.0	60.0	82.7	54.9	60.2
3-4 persons	93.3	95.3	70.8	84.3	92.9	69.7	81.3
5 or more persons	92.7	92.9	76.2	67.4	91.9	75.2	88.9

Table 3.—Estimated telephone coverage rates, by enrollment status, October 1987 and 1988 noninstitutionalized civilian population: 14-to 21-years old--Continued

Reporting category	October 1988				October 1987		
	Total	In school last year[1]	Status dropout	Event dropout	Total	Status dropout	Event dropout
	(Numbers in thousands)				(Numbers in thousands)		
Household type							
Husband and wife	95.1	96.1	76.7	79.4	94.5	76.0	89.7
Other family	86.4	88.9	65.6	69.6	85.1	64.4	76.7
Other type	92.7	78.2	54.4	[2]—	79.7	54.1	[2]—
Highest grade attended							
Grade 8 or less	79.2	85.3	60.8	67.2	77.9	65.9	81.6
Grade 9	89.2	92.0	63.8	61.7	89.4	60.2	85.5
Grade 10	91.8	94.8	73.0	83.1	90.1	67.4	76.7
Grade 11	90.4	93.4	70.9	72.7	91.1	70.6	76.3
Grade 12	91.2	95.5	86.1	84.9	90.4	83.3	89.9
Status							
Ever married	75.2	67.7	57.4	[2]—	75.2	57.2	70.9
Never married	93.0	94.1	74.4	77.6	92.5	73.3	83.0
Region							
Northeast	94.7	96.6	76.0	90.6	95.3	73.1	90.0
North Central	93.5	94.4	75.7	72.3	93.2	71.2	89.7
South	87.9	91.2	61.4	69.1	86.8	61.6	73.3
West	93.2	94.9	76.3	76.4	92.2	80.2	82.4
Tenure							
Owned	97.0	97.4	85.4	89.6	96.9	85.6	92.9
Rented	80.6	83.7	61.3	61.9	78.9	57.9	71.1

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]In school last year is defined as persons enrolled in October 1987 who did not graduate before October 1988.

[2]Estimate less than 2,000 persons.

Table 4.—Ratios of estimated totals to CPS totals using simple, poststratified, mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting Category	Simple adjustment			Poststratified			Mean adjusted poststratified			Within cell-adjusted poststratified		
	Total	Status dropouts	Event dropouts	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout
Overall	100.0	76.7	81.4	100.0	85.1	83.6	100.0	100.7	96.9	100.0	99.3	95.2
Age												
14	101.5	102.9	96.3	99.5	101.1	91.7	99.5	115.6	105.0	99.5	116.8	104.5
15	101.0	67.8	70.1	99.6	75.0	73.0	99.6	85.4	83.3	99.6	86.6	84.0
16	101.8	81.4	73.6	99.7	86.1	75.1	99.7	87.8	76.8	99.7	90.4	80.0
17	101.3	77.6	84.3	99.5	80.2	85.0	99.5	93.3	99.3	99.5	91.3	95.0
18	99.8	79.9	81.0	99.3	84.2	82.3	99.3	98.1	96.5	99.3	96.7	94.7
19	98.6	74.4	80.3	99.8	82.7	86.4	99.8	96.8	102.6	99.8	97.2	102.4
20	96.2	71.1	68.9	99.8	86.5	77.3	99.8	104.1	97.2	99.8	102.0	95.2
21	96.8	77.4	[1]---	99.7	88.7	[1]---	99.7	112.4	[1]---	99.7	108.7	[1]---
Race												
White	100.8	76.7	79.8	99.6	84.3	80.5	99.7	99.8	93.7	99.7	98.1	91.6
Black	92.1	74.1	83.7	99.6	86.5	91.2	99.5	102.2	104.7	99.5	102.5	105.0
Other	102.4	86.6	78.5	99.6	92.4	87.0	98.6	116.1	99.4	98.9	110.3	94.2
Ethnicity												
Hispanic	87.5	66.6	60.1	99.8	87.2	70.7	99.8	98.3	79.2	99.8	97.5	77.4
Non-Hispanic	101.2	80.9	85.3	99.9	85.2	85.8	99.9	102.9	100.3	99.9	101.2	98.4
Sex												
Male	100.0	77.2	82.2	100.0	85.6	83.9	100.0	101.7	98.2	100.0	100.3	96.5
Female	99.2	75.7	78.1	99.3	84.0	81.0	99.2	99.1	92.6	99.2	97.7	90.9
Family income												
Less than $10,000	78.7	56.1	63.7	83.9	65.2	67.6	85.1	76.3	78.2	85.2	76.8	78.4
$10,000 - $19,999	97.9	86.8	78.2	100.3	96.4	82.2	101.2	115.2	94.8	100.8	112.9	92.5
$20,000 and above	107.5	104.1	107.7	104.6	108.1	105.6	103.7	128.5	122.9	103.8	124.9	120.0
Household size												
1-2 persons	89.7	64.3	65.3	90.8	73.1	68.0	92.3	88.1	80.7	91.9	87.3	78.7
3-4 persons	101.4	76.9	90.6	100.7	3.8	91.5	100.4	99.5	106.6	100.5	97.2	104.0
5 or more persons	100.4	82.9	72.7	101.1	93.0	76.5	101.0	109.0	86.9	101.1	108.6	86.9
Household type												
Husband and wife	103.1	83.4	86.0	102.1	91.9	86.9	101.8	108.9	101.5	101.8	107.1	98.8
Other family	94.0	71.2	74.5	96.6	80.3	78.4	97.3	94.5	89.6	97.2	93.8	89.3
Other type	85.7	59.3	[1]---	84.5	62.4	[1]---	85.9	76.8	[1]---	85.5	74.8	[1]---

Table 4.—Ratios of estimated totals to CPS totals using simple, poststratified, mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14- to 21-years old-Continued

Reporting Category	Simple adjustment			Poststratified			Mean adjusted poststratified			Within cell-adjusted poststratified		
	Total	Status dropouts	Event dropouts	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout
Highest grade attended												
Grade 8 or less	85.7	66.2	73.3	89.4	77.2	74.7	92.5	88.4	82.7	92.3	87.9	82.3
Grade 9	96.8	69.5	67.2	96.8	78.5	69.5	98.1	90.7	78.4	98.2	91.7	78.1
Grade 10	99.8	79.5	90.6	99.7	89.6	93.9	101.8	105.5	108.7	101.7	104.6	106.5
Grade 11	98.2	77.2	79.2	97.5	84.7	81.9	99.8	101.5	95.1	99.4	99.8	93.8
Grade 12	98.8	92.1	87.7	99.7	95.6	88.2	100.6	119.1	105.9	99.8	112.9	102.4
Marital status												
Ever married	81.7	62.6	[1]---	86.1	72.1	[1]---	91.2	86.8	[1]---	90.1	85.0	[1]---
Never married	100.9	80.8	83.6	100.6	88.8	85.9	100.2	104.7	99.4	100.3	103.4	97.6
Region												
Northeast	102.6	82.5	96.7	102.8	92.2	99.7	102.4	109.0	115.9	102.4	106.4	112.0
North Central	101.5	82.4	78.8	100.6	88.5	80.7	100.5	106.6	93.8	100.6	105.4	93.1
South	95.3	66.6	73.9	96.1	73.0	76.0	96.1	87.0	88.6	96.1	86.0	86.9
West	101.4	83.2	83.3	101.0	95.4	85.4	101.6	110.8	97.3	101.5	109.6	96.3
Tenure												
Owned	105.3	92.6	96.0	103.7	97.0	95.1	103.0	116.7	111.1	103.1	113.1	107.9
Rented	87.5	66.7	67.0	90.8	77.4	71.9	92.3	90.6	82.6	92.2	90.5	82.2

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 5.—Ratios of estimated dropout rates to CPS dropout rates using simple, poststratified, and mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting Category	Simple adjustment		Poststratified		Mean adjusted poststratified		Within-cell adjusted poststratified	
	Status dropouts	Event dropouts	Status dropout	Event dropout	Status dropout	Event dropout	Status dropout	Event dropout
Overall	79.6	79.6	85.1	83.1	100.7	96.7	99.3	95.0
Age								
14	101.4	94.9	101.6	92.2	116.185.	105.6	117.4	105.1
15	67.1	69.2	75.3	73.2	8	83.6	86.9	84.3
16	79.9	72.0	86.380.	75.3	88.1	76.9	90.6	80.2
17	76.6	82.1	5	84.5	93.8	99.2	91.8	94.9
18	80.1	79.4	84.7	81.7	98.8	96.8	97.4	95.1
19	75.5	83.2	82.9	87.0	97.0	104.3	97.4	103.8
20	73.9	73.1	86.7	76.0	104.3	95.1	102.2	93.1
21	80.0	[1]---	89.0	[1]---	112.8	[1]---	109.0	[1]---
Race								
White	76.1	77.5	84.7	80.4	100.1	93.8	98.5	91.7
Black	80.5	88.3	86.8	91.5	102.7	105.5	103.0	105.8
Other	84.7	76.6	92.9	87.5	117.7	100.8	111.5	95.6
Ethnicity								
Hispanic	7.6	63.5	87.4	68.8	98.5	77.6	97.7	96.5
Non-Hispanic	79.9	83.1	85.3	85.8	103.0	100.5	101.3	98.7
Sex								
Male	77.1	80.5	85.6	83.6	101.6	98.1	100.3	96.5
Female	76.3	77.1	84.6	81.1	100.0	93.2	98.5	91.6
Family income								
Less than $10,000	71.2	75.8	77.8	76.4	89.7	88.5	90.1	88.6
$10,000 - $19,999	88.6	78.8	96.1	82.4	113.8	95.3	112.0	93.1
$20,000 and above	96.8	100.0	103.3	102.0	123.8	119.2	120.3	116.4
Household size								
1-2 persons	71.7	69.4	80.5	72.7	99.5	85.9	95.0	84.1
3-4 persons	75.8	87.5	83.3	90.5	99.1	105.8	96.7	103.2
5 or more persons	82.5	72.3	92.0	76.8	107.9	87.6	107.5	87.5
Household type								
Husband and wife	80.9	82.5	90.0	85.5	107.0	100.3	105.2	97.7
Other family	75.7	77.2	83.1	80.6	97.2	92.4	96.5	92.0
Other type	69.2	[1]---	73.8	[1]---	89.4	[1]---	87.5	[1]---

Table 5.—Ratios of estimated dropout rates to CPS dropout rates using simple, poststratified, and mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14- to 21-years old-Continued

Reporting Category	Simple adjustment		Poststratified		Mean adjusted poststratified		Within-cell adjusted poststratified	
	Status dropouts	Event dropouts	Status dropout	Event dropout	Status dropout	Event dropout	Status dropout	Event dropout
Highest grade attended								
Grade 8 or less	77.2	79.6	86.4	80.3	95.6	88.7	95.3	88.3
Grade 9	71.7	67.4	81.1	70.6	92.5	79.6	93.4	79.2
Grade 10	79.7	87.9	89.8	92.7	103.6	107.0	102.9	104.9
Grade 11	78.7	78.1	86.8	82.5	101.7	95.7	100.4	94.6
Grade 12	93.2	84.9	95.9	86.7	118.4	104.9	113.1	101.3
Marital status								
Ever married	76.6	[1]—	83.7	[1]—	95.2	[1]—	94.4	[1]—
Never married	80.1	81.9	88.3	85.5	104.5	99.4	103.1	97.7
Region								
Northeast	80.4	92.6	89.6	97.0	106.5	113.1	103.9	109.4
North Central	81.2	77.0	88.0	80.6	106.1	93.9	104.8	93.3
South	69.9	74.8	75.9	77.3	90.5	90.5	89.5	88.8
West	82.0	80.7	94.4	84.8	109.1	97.0	108.0	96.0
Tenure								
Owned	87.9	91.0	93.5	92.4	113.3	108.5	109.7	105.5
Rented	76.2	73.8	95.2	77.9	98.2	89.6	98.1	89.1

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 6.—Summary statistics of ratios of estimated totals to CPS totals using simple, poststratified, and mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14- to 21-years old

Reporting Category	Simple adjustment			Poststratified			Mean adjusted poststratified			Within cell-adjusted poststratified		
	Total	Status dropouts	Event dropouts	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout	Total	Status dropout	Event dropout
Number of observations	38	38	35	38	38	35	38	38	35	38	38	35
Mean	97.2	77.2	80.0	98.0	85.2	82.7	98.5	100.8	95.6	96.9	93.4	89.2
Median	99.8	77.2	80.3	99.7	85.4	83.6	99.8	101.1	97.2	100.0	104.6	98.8
Standard Deviation	6.6	10.5	10.3	5.0	9.4	8.9	4.2	11.8	11.2	4.6	7.7	7.0
Range	28.8	48.0	47.6	20.7	45.7	38.1	18.7	52.1	46.1	18.6	50.1	42.6

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

Table 7.—Summary statistics of ratios of estimated dropout rates to CPS dropout rates using simple, poststratified, and mean adjusted, and within-cell adjusted poststratified estimators, October 1988 noninstitutionalized civilian population: 14 to 21 years old

Reporting Category	Simple adjustment		Poststratified		Mean adjusted poststratified		Within-cell adjusted poststratified	
	Status dropouts	Event dropouts	Status dropout	Event dropout	Status dropout	Event dropout	Status dropout	Event dropout
Number of Observations	38	35	38	35	38	35	38	38
Mean	79.2	79.8	86.8	83.1	102.1	96.3	100.8	94.8
Median	77.9	79.6	86.3	83.1	101.2	96.8	99.8	95.0
Standard Deviation	7.1	7.9	6.5	7.4	9.0	9.6	8.0	8.8
Range	34.3	36.5	29.5	33.2	38.1	42.3	33.4	40.6

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

Table 8.—Estimated number of 3- to 5-year-olds in telephone and nontelephone households by enrollment status, October 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting Category	Telephone households				Nontelephone households			
	Total	In nursery school or kindergarten	In nursery school	In kindergarten	Total	In nursery school or kindergarten	In nursery school	In kindergarten
	(Numbers in thousands)				(Numbers in thousands)			
Overall	9,684	5,699	2,434	3,063	1,265	526	154	365
Age								
3	3,241	933	894	39	465	51	49	2
4	3,105	1,608	1,318	289	405	136	95	41
5	3,338	3,158	222	2,734	396	339	10	322
Race								
White	8,057	4,739	2,122	2,516	805	321	99	219
Black	1,183	671	194	404	400	185	54	127
Other	444	289	118	143	60	21	2	19
Ethnicity								
Hispanic	977	471	120	327	292	107	16	92
Non-Hispanic	8,651	5,194	2,306	2,710	967	419	138	273
Sex								
Male	4,955	2,877	1,218	1,559	667	290	69	218
Female	4,729	2,822	1,217	1,504	598	236	85	147
Family income								
Less than $10,000	1,343	680	236	418	743	299	85	211
$10,000 - $19,999	2,843	1,450	468	919	393	165	60	102
$20,000 and above	5,158	3,362	1,648	1,613	49	20	9	11
Household size								
1-2 persons	266	170	80	85	65	35	13	22
3-4 persons	5,752	3,380	1,535	1,745	616	265	86	175
5 or more persons	3,667	2,149	820	1,233	584	226	55	168
Household type								
Husband and wife	7,844	4,656	2,058	2,454	590	590	56	159
Other family	1,767	996	356	586	663	663	97	206
Other type	73	47	20	23	12	12	1	[1]0
Region								
Northeast	1,894	1,219	564	581	169	169	27	40
North Central	2,423	1,369	640	717	215	215	31	67
South	3,048	1,800	723	1,022	670	670	72	186
West	2,320	1,312	508	743	211	211	23	72
Tenure								
Owned	6,366	3,974	1,782	2,089	213	213	49	51
Rented	3,311	1,718	651	969	1,049	1,049	106	311

SOURCE: Special tabulations of the 1988 October and November Current Population Survey.

[1]EStimate less than 1,000 persons.

Table 9.—Estimated percent enrolled for 3- to 5-year-olds in telephone and nontelephone households, October 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting Category	All households			Telephone households			Nontelephone households		
	Percent enrolled	Percent in nursery school	Percent in kindergarten	Percent enrolled	Percent in nursery school	Percent in kindergarten	Percent enrolled	Percent in nursery school	Percent in kindergarten
Overall	56.9%	23.6%	31.3%	58.9%	25.1%	31.6%	41.6%	12.2%	28.8%
Age									
3	26.6	25.4	1.1	28.8	27.6	1.2	11.0	10.5	0.5
4	49.7	40.3	9.4	51.8	42.5	9.3	33.6	23.5	10.1
5	93.7	6.2	81.9	94.6	6.7	81.9	85.6	2.5	81.3
Race									
White	57.1	25.1	30.9	58.8	26.3	31.2	39.8	12.3	27.2
Black	54.1	15.7	33.5	56.8	16.4	34.2	46.2	13.5	31.7
Other	61.3	23.8	32.2	65.0	26.7	32.2	34.3	2.5	31.7
Ethnicity									
Hispanic	45.6	10.7	33.0	48.3	12.3	33.5	36.8	5.5	31.3
Non-Hispanic	58.4	25.4	31.0	60.0	26.7	31.3	43.3	14.3	28.3
Sex									
Male	56.3	22.9	31.6	58.1	24.6	31.5	43.5	10.4	32.7
Female	57.4	24.4	31.0	59.7	25.7	31.8	39.4	14.2	24.5
Family income									
Less than $10.000	47.0	15.4	30.2	50.7	17.5	31.2	40.3	11.5	28.3
$10.000 - $19.999	49.9	16.3	31.5	51.0	16.5	32.3	42.0	15.2	26.0
$20.000 and above	65.0	31.8	31.2	65.2	31.9	31.3	[1]0	18.9	[1]0
Household size									
1-2 persons	62.3	28.0	32.3	64.2	30.0	31.9	54.6	19.9	33.8
3-4 persons	57.2	25.5	30.2	58.8	26.7	30.3	43.0	14.0	28.4
5 or more persons	55.9	20.6	33.0	58.6	22.4	33.6	38.6	9.4	28.7
Household type									
Husband and wife	57.8	25.1	31.0	59.4	26.2	31.3	37.0	9.5	27.0
Other family	53.6	18.7	32.5	56.4	20.2	33.1	46.3	14.7	31.0
Other type	56.1	24.6	27.5	64.6	27.9	32.0	[1]---	4.3	[1]---
Region									
Northeast	62.3	28.6	30.1	64.3	29.8	30.7	39.8	16.1	23.7
North Central	55.7	25.5	29.7	56.5	26.4	29.6	47.2	14.6	31.3
South	55.5	21.4	32.5	59.1	23.7	33.5	39.1	10.8	27.7
West	55.6	21.0	32.2	56.6	21.9	32.0	45.0	11.1	33.9
Tenure									
Owned	62.0	27.8	32.5	62.4	28.0	32.8	48.1	22.9	23.8
Rented	49.0	17.3	29.3	51.9	19.7	29.3	40.1	10.1	29.6

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 10.—Estimated telephone coverage rates by enrollment status, October 1987 and 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting Category	October 1988				October 1987			
	Total	In school	In nursery school	In kindergarten	Total	In school	In nursery school	In kindergarten
Overall	88.4%	91.6%	94.0%	89.4%	87.7%	90.9%	92.8%	89.4%
Age								
3	87.5	94.8	94.8	[1]—	87.0	93.5	93.7	[1]—
4	88.5	92.2	93.3	87.6	86.4	90.1	91.8	84.4
5	89.4	90.3	95.7	89.5	89.5	90.6	94.3	90.1
Race								
White	90.9	93.7	95.6	92.0	89.9	93.6	95.2	92.4
Black	74.7	78.4	78.2	76.1	74.8	76.5	76.1	75.4
Other	88.1	93.3	98.7	88.2	88.3	88.5	83.4	91.7
Ethnicity								
Hispanic	77.0	81.4	88.3	78.1	73.9	79.0	76.3	79.4
Non-Hispanic	89.9	92.5	94.3	90.8	89.6	92.2	94.0	90.7
Sex								
Male	88.1	90.8	94.6	87.7	87.8	91.1	93.5	89.0
Female	88.8	92.3	93.5	91.1	87.5	90.8	91.9	89.7
Family income								
Less than $10,000	64.4	69.4	73.4	66.5	62.5	66.7	61.8	68.2
$10,000 - $19,999	87.8	89.8	88.7	90.0	84.6	87.5	86.1	87.8
$20,000 and above	99.1	99.4	99.4	99.3	98.1	98.8	99.5	98.1
Household size								
1-2 persons	80.4	82.8	86.0	79.4	81.5	91.0	83.3	95.8
3-4 persons	90.3	92.7	94.7	90.9	89.3	92.7	94.5	90.9
5 or more persons	86.3	90.5	93.7	88.0	86.3	89.0	91.2	87.3
Household type								
Husband and wife	93.0	95.5	97.3	93.9	91.8	94.5	96.5	92.9
Other family	72.7	76.4	78.5	74.0	72.3	76.5	74.1	77.3
Other type	85.8	[1]—	[1]—	[1]—	79.5	92.1	[1]—	[1]—
Region								
Northeast	91.8	94.8	95.4	93.6	91.3	92.6	93.2	91.8
North Central	91.8	93.1	95.3	91.4	90.9	93.4	94.1	92.7
South	82.0	87.3	90.9	84.6	81.8	87.1	89.4	85.4
West	91.6	93.2	95.6	91.2	89.1	91.9	94.6	90.3
Tenure								
Owned	96.8	97.5	97.3	97.6	95.7	97.0	98.3	96.0
Rented	75.9	80.3	86.0	75.7	75.0	79.5	79.1	79.1

SOURCE: Special tabulations of the 1987 and 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 11.—Ratios of estimated totals to CPS totals using simple and poststratified estimators, October 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting Category	Simple adjustment				Poststratified			
	Total	In school	In nursery school	In kindergarten	Total	In school	In nursery school	In kindergarten
Overall	100.0	103.5	106.3	101.0	100.0	101.6	102.6	100.1
Age								
3	98.9	107.2	107.2	[1]---	100.0	103.7	103.5	[1]---
4	100.0	104.2	105.4	99.1	100.0	101.9	101.3	104.4
5	101.1	102.1	108.2	101.2	100.0	100.9	106.9	99.5
Race								
White	102.8	105.9	108.0	104.0	100.1	101.2	101.8	100.5
Black	84.5	88.7	88.5	86.1	100.1	103.0	106.2	98.2
Other	99.6	105.5	111.6	99.7	98.8	103.3	109.6	98.4
Ethnicity								
Hispanic	87.0	92.1	99.8	88.3	100.0	105.6	118.1	100.0
Non-Hispanic	101.7	104.6	106.7	102.7	100.0	101.1	101.7	100.0
Sex								
Male	99.6	102.7	107.0	99.2	99.8	101.0	102.7	98.7
Female	100.4	104.3	105.7	103.0	100.2	102.3	102.5	101.5
Family income								
Less than $10,000	72.8	78.5	83.0	75.2	82.8	87.8	95.1	83.0
$10,000 - $19,999	99.3	101.5	100.3	101.7	103.3	104.2	101.0	104.6
$20,000 and above	112.0	112.4	112.4	112.3	105.5	105.1	104.4	105.6
Household size								
1-2 persons	90.9	93.6	97.3	89.8	92.5	94.6	99.3	90.6
3-4 persons	102.1	104.8	107.0	102.7	100.8	101.5	102.5	100.3
5 or more persons	97.5	102.3	106.0	99.5	99.3	102.3	103.2	100.5
Household type								
Husband and wife	105.2	108.0	110.1	106.2	103.1	104.1	103.8	103.7
Other family	82.2	86.4	88.8	83.7	89.3	91.8	96.7	87.5
Other type	97.1	[1]---	[1]---	[1]---	100.3	[1]---	[1]---	[1]---
Region								
Northeast	103.8	107.2	107.2	105.8	102.6	104.0	104.4	102.5
North Central	103.8	105.2	105.2	103.4	101.3	100.3	102.1	98.9
South	92.7	98.7	98.7	95.7	93.9	98.7	99.5	97.2
West	103.6	105.4	105.4	103.1	105.4	105.1	106.0	103.5
Tenure								
Owned	109.4	110.2	110.2	110.4	105.5	104.8	102.6	106.6
Rented	85.9	90.8	90.8	85.6	91.7	95.6	102.7	89.4

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 12.—Ratios of estimated percent enrolled to CPS percent using simple and poststratified estimators, October 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting Category	Simple adjustment			Poststratified		
	Percent in school	Percent in nursery school	Percent in kindergarten	Percent in school	Percent in nursery school	Percent in kindergarten
Overall	103.5	106.3	101.0	101.6	102.6	100.1
Age						
3	108.4	108.4	[1]---	103.7	103.5	[1]---
4	104.2	105.4	99.1	101.9	101.3	104.4
5	101.0	107.0	100.1	100.9	106.9	99.5
Race						
White	103.0	105.1	101.2	101.2	101.8	100.5
Black	104.9	104.7	101.9	102.9	106.1	98.2
Other	106.0	112.1	100.2	104.5	110.9	99.5
Ethnicity						
Hispanic	105.8	114.7	101.5	105.6	118.1	100.0
Non-Hispanic	102.9	104.9	101.0	101.1	101.7	100.0
Sex						
Male	103.1	107.4	99.5	101.2	102.9	98.9
Female	104.0	105.3	102.6	102.0	102.3	101.3
Family income						
Less than $10,000	107.9	114.0	103.3	106.0	114.8	100.3
$10,000 - $19,999	102.2	101.0	102.4	100.9	97.8	101.3
$20,000 and above	100.3	100.4	100.3	104.5	99.0	100.1
Household size						
1-2 persons	103.0	107.1	98.8	102.3	107.3	98.0
3-4 persons	102.7	104.8	100.6	100.7	101.6	99.4
5 or more persons	104.9	108.6	102.0	103.0	103.9	101.2
Household type						
Husband and wife	102.7	104.7	101.0	100.9	100.7	100.6
Other family	105.1	108.0	101.8	102.8	108.4	98.0
Other type	[1]---	[1]---	[1]---	[1]---	[1]---	[1]---
Region						
Northeast	103.2	103.9	101.9	101.3	101.7	99.9
North Central	101.4	103.8	99.5	98.9	100.8	97.6
South	106.5	110.9	103.2	105.1	105.9	103.5
West	101.7	104.3	99.5	99.7	100.5	98.2
Tenure						
Owned	100.7	100.6	100.9	99.4	97.2	101.0
Rented	105.8	113.3	99.7	104.2	111.9	97.4

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

[1]The value of the estimate was suppressed because the base was less than 50,000.

Table 13.--Summary statistics of ratios of estimated totals to CPS totals using simple and poststratified estimators, October 1988 noninstitutionalized civilian population: 3 to 5 years old

Reporting category	Simple adjustment				Poststratified			
	Total	In school	In nursery school	In kindergarten	Total	In school	In nursery school	In kindergarten
Number of observations	26	25	2.5	24	26	25	25	24
Mean	97.5	101.0	103.7	98.3	99.1	101.0	103.2	99.0
Median	99.8	104.2	106.7	101.1	100.0	101.9	102.6	100.1
Standard Deviation	8.9	8.2	7.5	9.0	5.2	4.4	4.3	5.9
Range	39.2	33.9	29.4	37.1	22.7	17.8	23.0	23.6

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

Table 14.—Summary statistics of ratios of estimated percent enrolled to CPS percent using simple and poststratified estimators, October 1988 noninstitutionalized civilian population: 3- to 5-years old

Reporting category	Simple adjustment			Poststratified		
	Percent in school	Percent in nursery school	Percent in kindergarten	Percent in school	Percent in nursery school	Percent in kindergarten
Number of observations	25	25	24	25	25	24
Mean	103.8	106.7	101.0	102.1	104.4	100.0
Median	103.2	105.4	101.0	101.6	102.6	100.0
Standard Deviation	2.1	3.9	1.3	1.9	5.2	1.7
Range	8.0	14.3	4.5	7.0	20.9	7.0

SOURCE: Special tabulations of the 1988 October and November Current Population Surveys.

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APPENDIX

Source and Reliability of Estimates

The estimates contained in this report are derived from samples and are subject to sampling and nonsampling errors. Sampling errors occur because the data are collected from a sample of the population rather than from the entire population. If the entire population were enumerated, there would not be any sampling error. The differences in the estimates due to the fact that only a sample has been observed are referred to as sampling errors.

Nonsampling errors come from a variety of sources and affect all surveys, even surveys which enumerate the entire population. This report has concentrated on one type of nonsampling error for the NHES: the nonsampling error arising because households without telephones are eliminated from the survey. The CPS is also subject to nonsampling error arising from sources such as coverage, other types of design decision, data collection procedures, processing procedures, and reporting procedures. To the extent possible, procedures are built into surveys to minimize nonsampling errors.

The standard error of an estimate is a measure of the sampling variability associated with that estimate. The standard error can be used to construct confidence intervals which are ranges that would include the average result of all possible samples with a known probability. In other words, if all possible samples were selected, then about 95 percent of the intervals constructed by taking the sample average and adding or subtracting two times the sample standard error would include the average over all the possible samples.

The approximate standard error for an estimate from the CPS may be computed using the following formulas, as suggested by the Bureau of the Census ("School Enrollment-Social and Economic Characteristics of Students: October 1986," *Current Population Reports*, Series P-20, No. 429):

Number of persons

$$s.e.(x) \approx \sqrt{\frac{b}{T}X^2 + bX}$$

Percentage of persons

$$s.e.(P) \approx \sqrt{\frac{b}{X}P(100-P)}$$

where

X = the estimated number of persons with the characteristic;

T = the estimated total population in the category;

P = the estimated percentage of persons with the characteristic; and

b = 2,312 for total or white population 14 to 21 years old

2,600 for Black or Hispanic population 14 to 21 years old

2,698 for all populations 3 to 5 years old.

The approximate standard error for a proportion, such as the telephone coverage rate, can be computed using the following formula:

Ratio of persons

$$s.e.(r) \approx \sqrt{\frac{b}{Y}r(1-r)}$$

where $r = \frac{X}{Y}$, the ratio of two estimates.

These approximations for the standard errors of estimates were computed based upon the full household sample from the CPS. Since only about 71 percent of the sample is used in the analysis of the undercoverage, the approximations may underestimate the standard errors of the estimates. One rough method to compensate for the reduced sample size is to increase the parameter b by a factor of 1.4.

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